DECEMBER 1960 / 50¢

AIR FORCE

and SPACE DIGEST

The Magazine of Aerospace Power / Published by the Air Force Association

SPACE: LABORATORY AND BATTLEFIELD

Page 37 and 57

RELIABLE HUSKIE... WELCOME SIGHT IN MISSILE SUPPORT

The kind of support a missile site may need in an emergency may be technicians, equipment, liaison or surveillance.

Regardless of weather, when support is needed, it is critical and it must be fast and reliable.

In its support missions, the Kaman HUSKIE can carry precious cargo inside, bulk cargo outside.

Built by the people who pioneered turbine powered helicopters, the HUSKIE, already on duty with the Air Force all over the world, has the reliability, capacity, and versatility to become the vital link in the chain of missile site support.

pioneers in turbine powered helicopters

THE KAMAN AIRCRAFT CORPORATION • BLOOMFIELD, CONN.

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News of the recapture of Condé from the Austrians was sped to the French Revolutionary Convention at Paris in a matter of minutes via Claude Chappe's amazing télégraphe aérienne, or relay aerial telegraph, Sept. 1, 1794. A new era in rapid communications had begun. / Today, instantaneous and completely reliable Electronic Communications insure the immediate and continuous interchange of intelligence throughout the Free World. ECI is proud of its initiative and responsibilities in the design, development and manufacture of high precision electronic equipment to the critical specifications required in various aerospace and surface roles vital to our National Defense and to scientific achievement. An example is ALRI—Airborne Long Range Input—a program where ECI communications and data link equipment fill an integral and essential requirement in linking USAF's advanced early warning system to SAGE—our continental defense network.

The Bettmann Archive / One of a series depicting historic incidents in military communications

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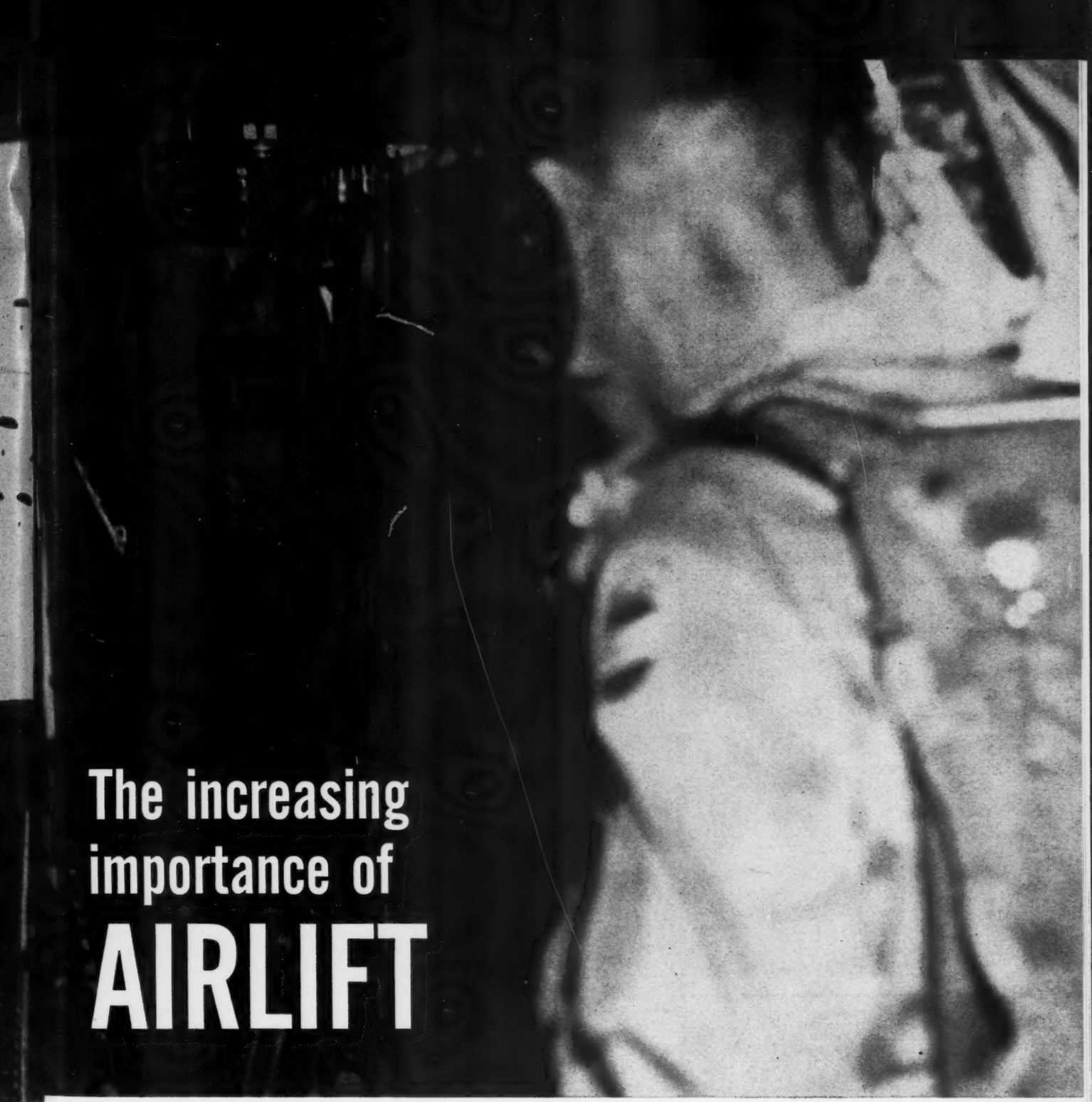

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Even in peacetime, airlift plays a vital role in supporting our missile bases, airborne combat forces, and strategic and tactical operations throughout the world. In wartime, the airlift burden would increase a hundredfold. America's airlift capacity must keep pace with other top-priority projects so that it can provide the support needed to keep them in operational readiness.

Three years of world-wide service with the U. S. Air Force have demonstrated conclusively that the Lockheed C-130 prop-jet HERCULES transport will provide the most Jet Age airlift per dollar.

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WORLD HEADQUARTERS FOR AIRLIFTERS AND CARGOLOADERS

AIR FORCE and SPACE DIGEST

THE MAGAZINE OF AEROSPACE POWER

Volume 43, Number 12 • December 1960

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FEATURES

Mr. Kennedy and National Defense
A SPECIAL REPORT 5

Space—Laboratory and *Battlefield*
JOHN F. LOOSBROCK 37

Meteors, Mischief, and War
THOMAS C. SCHELLING 40

Security Is Aerospace Power
THE HON. DUDLEY C. SHARP 46

Living with Danger
GEN. THOMAS D. WHITE, USAF 48

Our Airborne Triple-Threat Force
GEN. FRANK F. EVEREST, USAF 51

Strategy from A to Z—A Primer
COL. PAUL S. DEEMS, USAF 58

SPACE DIGEST

The Military Mission in Space—A Symposium 67

Deterrence Decades Hence
LT. GEN. JAMES H. DOOLITTLE, USAF (RET.) 68

Four Criteria for the Mission
RICHARD E. HORNER 70

What We Need to Do the Job
GEORGE P. SUTTON 74

The Space Arena
DR. EDWARD TELLER 78

The Panelists Sum It Up 84

Space—Tomorrow's Battleground
MAJ. GEN. OSMOND J. RITLAND, USAF 89

Speaking of Space
WILLIAM LEAVITT 94

Mobilizing Industrial Know-How—A Seminar 101

Management's Key to Survival
LT. GEN. BERNARD A. SCHRIEVER, USAF 102

"Crisis in Command"
MAJ. GEN. KENNETH P. BERGQUIST, USAF 105

Strategy in Peace and War
C. W. HALLIGAN 107

Space Shots, Long Shots
DR. IVAN A. GETTING 110

Changes, Challenges, and Checkbooks
LT. GEN. WILLIAM F. MCKEE, USAF 113

"Guesstimates" Went That-a-Way
MAJ. GEN. WAYMOND A. DAVIS, USAF 115

Mission: Get Results
MAJ. GEN. CLYDE H. MITCHELL, USAF 120

USAF's 10,000-Mile Production Line
MAJ. GEN. THOMAS P. GERRITY, USAF 124

DEPARTMENTS

Airmail 11
What's New With Red Airpower 15
Airpower in the News 19
Aerospace World 26
The Ready Room 131
AFA News 135
Airman's Bookshelf 140
Index to Advertisers 147
This Is AFA 148

The nation's President-Elect has expressed himself frequently and with vigor on defense problems. He has turned his attention to hardware and organization, developments in space and science, and the basic issue of military spending . . .

MR. KENNEDY AND NATIONAL DEFENSE

A SPECIAL REPORT

VITAL issues of national defense will be among the major business awaiting President-Elect John F. Kennedy and his Administration after the last hurrahs of Inauguration Day have died away.

Where does the new President stand on the wide range of problems in this complex area? Let's look at the record, as politicians like to say.

The record will show that Mr. Kennedy has expressed himself frequently and with vigor on defense problems. Last July, in Los Angeles, he pledged support to a defense plank in his party's platform that declared the "first order of business of a Democratic Administration will be a complete reexamination of the organization of our armed forces." Senator Kennedy later rephrased it more forcefully. "We must organize the defense establishment in order to revive the capacity for decision," he said.

On August 7, 1960, Senator Stuart Symington, a consistent critic of Administration defense policies during the past eight years, was commissioned by Senator Kennedy to head an advisory Committee. The Symington committee will, by December 31, recommend to President-Elect Kennedy changes in the organization and administration of the defense agencies to eliminate "without delay" what Senator Kennedy has called "the present crippling effect of those problems upon our power."

Senator Kennedy has shown great interest in the concept of a functional-command organization of our armed strength. At the senator's direction, the committee is studying the feasibility and efficiency of: (1) A Strategic Command which would embrace all the weapons and capabilities contributing to our strategic striking force; and (2) a Tactical Command comprising those combat elements contributing to our "brush-fire" war capabilities. Three other basic entities in this scheme would include: (1) A Continental Defense Command (2) a Materiel Command; and (3) a Development Command. Their basic functions are suggested by their titles. Each command would embrace Air Force, Army, and Navy forces.

Senator Kennedy has promised that the Symington Committee will seek the views of each military service and of defense industry, as well as qualified and experienced civilians, regardless of political affiliation or service backgrounds.

The Navy has thus far successfully resisted efforts to place its Polaris in a joint Strategic Command along with SAC, although a joint strategic targeting agency has been set up. The sweeping mandate given to Senator Symington's committee has deepened Navy concern.

President-Elect Kennedy, Vice President-Elect Johnson. Their platform contained a major national defense plank.

Navy anxieties may be needless for the time being. Senator Kennedy has never officially supported a single service although he feels that the pressures of new weapons make the evolution toward it inevitable. For his part, Senator Symington has enthusiastically supported additional appropriations to fund both Polaris and the Army's limited-war capability. Last February, the Missouri senator introduced a bill providing for a reorganization of the Department of Defense which has been described as "evolutionary in nature, rather than revolutionary."

The Symington bill provided for a Chief of Staff to the Secretary of Defense to replace the present JCS Chairman. He would be given power of decision over all matters arising for determination by the Joint Chiefs, thus eliminating the "splits" which have plagued the JCS since World War II. Under the proposed legislation, the Chiefs would have retained their dual roles as members of JCS and as military heads of their services.

Symington's bill would have placed the Chief of Staff, DoD, in the chain of command over the unified commands between the Secretary of Defense and the President. He

(Continued on following page)

would also have reduced the service Secretaries in stature to the rank of Under Secretaries of Defense for Army, Navy, and Air.

If the President-Elect has shown favoritism toward any service it is not reflected in his across-the-board program to "recast our military program and systems during the next years." He promised the American Legion, if elected, to submit a specific supplemental budget request in January 1961 to the Congress urging this order of priorities:

- "We must take immediate steps to protect our present nuclear striking force from surprise attack." He pointed out that "more than ninety percent of our retaliatory force is made up of aircraft and missiles which move from unprotectable bases whose location is known to the Russians."
- "Crash programs" on what he called "ultimate" weapons, Polaris and Minuteman, "which will eventually close the missile gap." In other statements, Senator Kennedy had rejected the sophistry of convenient distinctions made between "the missile gap" and what was called "the deterrent gap."
- Modernization of the ground forces, "especially . . . an airlift capacity to the armed services, particularly the Army. It doesn't do any good," he said, "to have seventeen divisions stationed here if you can't move them around the world within twenty-four or forty-eight hours. I would put that near the top," he added.

In other statements, Senator Kennedy urged: "We must do more on antisubmarine warfare" to cope with the increasing threat of Soviet submarines. He promised to "speed up" development of space warning and antimissile weapon systems.

Mr. Kennedy has, to a large extent, stood clear of the B-70 controversy.

In his last preelection swing, he castigated the Administration in a California speech for allegedly attempting to buy votes in that state with funds restored to the B-70 project. Although he voted for the B-70, Mr. Kennedy has not availed himself of opportunities to urge a speedup. In mid-October 1960, he responded to a questionnaire on defense subjects in the affirmative with respect to accelerating, expanding, or modernizing various capabilities. But he omitted comment on the B-70.

The new President has spoken out perhaps most strongly on space matters.

On October 10, 1960, he said, "We are in a strategic space race with the Russians, and we have been losing." And Mr. Kennedy stands on the Democratic platform, which promises to "press forward with our national space program in full realization of the importance of space accomplishments to our national security and our international prestige."

During his nonstop campaign, Mr. Kennedy seldom let pass an opportunity to refer to the lag in our progress and prestige in vital scientific areas. Thus when Vice President Nixon presented his political position paper on science ("The Scientific Revolution") which proposed a number of federally aided institutes for basic research, the voters were treated to a debate on a rather novel subject. Never before had science become a political issue in which a presidential nominee could interest voters even in Cambridge, much less in Kankakee.

Now, the incoming Chief Executive is reported to be giving serious consideration to establishing on a cabinet level a Department of Science. We recall that he cosponsored a bill with Senator Lister Hill to establish a national medical library to promote research and to bring together under one roof the results of research in the many fields of medicine.

In another area, he has applied similar logic to an expression of his fundamental belief that scientific research will produce the formula to dissolve the disarmament impasse with the Soviet Union. "No issue," he said last March, "is of more vital concern to this nation . . . no issue could demand more priority of top level attention than disarmament."

To this end, Senator Kennedy introduced in the last session a bill to establish an Arms Control Research Institute. Under the immediate direction of the President, the Institute would direct the research, development, and field projects out of which could be distilled a practical program.

President Kennedy may reasonably hope that a US Arms Control Research Institute will receive early legislative attention in the Eighty-seventh Congress. Certainly time is of the essence. During the campaign, Senator Kennedy had rejected the suggestion of Thomas E. Murray, former AEC member, to resume atomic testing underground or in outer space. "I would want to exhaust all reasonable opportunities to conclude an effective international agreement banning all tests—with effective international inspection and controls—before ordering a resumption of tests," he wrote.

Starting on January 21, 1961, the new Chief Executive will be under great pressure by advisers who are disposed to believe that the Soviet Union is furtively conducting nuclear tests. The way President Kennedy resolves this conflict will bear heavily on the nation's security.

One underlying point, perhaps the key to the Kennedy approach in this whole area, is this. President-Elect Kennedy will be under no illusions that the accelerated defense programs he desires can be wholly or even substantially financed out of economies. In the Senate a few months ago, he said: "I do not want to be told either that we cannot afford to do what is required or that our people are unwilling to do it. The only real question is, which chance, which gamble, do we take—our money or our survival? The money must be appropriated now—the survival will not, we hope, be at stake for a few more years."

On November 3, the New York *Daily News* published a national defense statement by the President-Elect that perhaps best sums up his expressed views. He said:

"The question of national defense involves two separate judgments. They should be clearly distinguished.

"If the United States should be attacked today, I believe that we are militarily prepared to withstand the attack and to retaliate effectively. But the issue in this campaign is whether we will be as well prepared two or three years from now.

"Here are some of the hard truths. During the past seven and one-half years our military strength has been declining relative to that of the Communist bloc. The Soviet Union now leads us in numbers of intercontinental missiles, in many of the pioneer efforts in the space race, and in modernized conventional forces. Unless we act promptly, we may find ourselves, by 1962 or 1963, in a most difficult position.

"This is not just a campaign issue—it is a survival issue. We must take immediate steps to ensure that we will have a deterrent nuclear power of such strength that it will convince the Communist leaders that an attack on the United States would be followed by their own destruction.

"We must make sure we have balanced conventional forces capable of stamping out brush-fire wars with speed and certainty. These forces must be kept at peak efficiency at all times through a continuous modernization program. Our needs are clear. To meet them, we must have vigorous leadership."—END

COMPUTENCE

total competence in computation and data processing—the breadth, the brains and the background

The term: created by necessity to distinguish the new concept in computation—the computation of Burroughs Corporation. **Domain:** weapons systems, support systems for space, air, land and sea. **Qualifications:** 75 years devoted to computation and data processing; membership on Polaris and Atlas teams; system management of the ALRI team; facilities that range from basic research through production to field service. **Credentials:** high-speed computation for Polaris, miniaturized airborne data processors for ALRI, the Atlas computers that guided Explorer I, Transit and Midas satellites into orbit. **Destination:** the unknown, where total competence in computation and data processing crystallizes into Comp**u**tence to point the way.

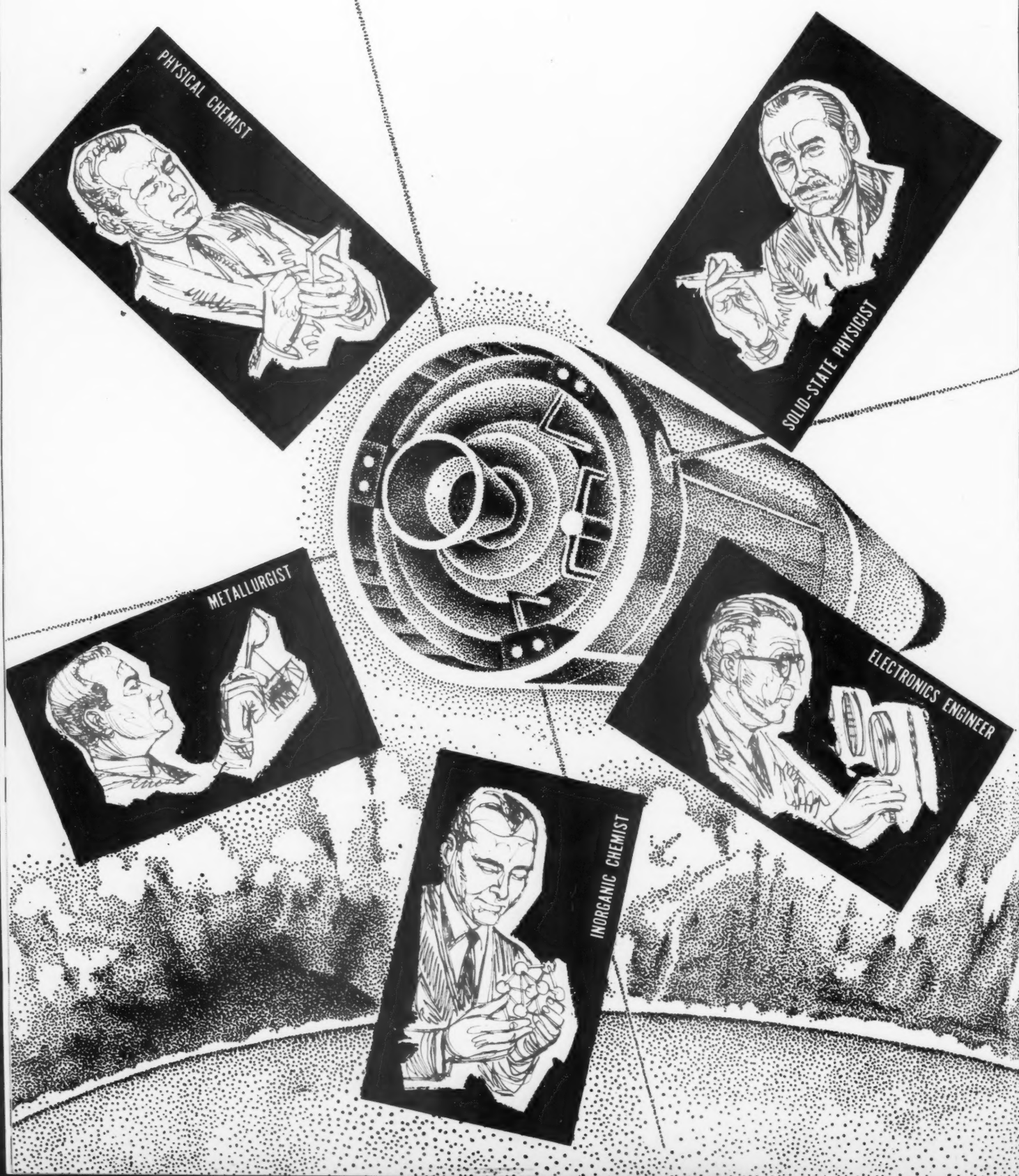
Burroughs Corporation

"NEW DIMENSIONS / in computation for military systems"

Monsanto

Space-Age Project "ELECTRON"

A CHEMICAL EXPEDITION...r



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In

...ranging the fields of ultra-pure metals and "intermetallics"...finds new chemical routes to materials for advanced electronics

Monsanto research in the chemistry of silicon, phosphorus, ultra-fine metals and oxides, and "super-pure" elements and compounds has found promising leads to improve semiconductors. These materials—developed by the synergistic collaboration of solid-state physicists, inorganic chemists, and physical chemists—forecast improved performance of transistors, photoconductors, thermoelectric generators and coolers, solar batteries, rectifiers, thermistors and other electronic applications that depend upon the tractability and mobility of electrons moving through special composition solids.

Monsanto researchers, from a firm base in the commercial production of semiconductor silicon (under Siemens-Westinghouse license), have found a number of intriguing leads to new and improved semiconductor materials suitable for transistors, rectifiers, diodes, thermoelectric coolers and generators, and Hall-effect devices.

Since the middle 50's—the burgeoning uses of transistors, diodes, rectifiers, as well as thermoelectric, photoelectric, and servo devices, have kept chemists on a dogged search for substances with a given quantum of mobile electrons that would behave predictably. To the "armchair chemist" the semiconductor problem might look deceptively simple: check out a relatively few elements and compounds, purify them highly, dope them in the order of 1:10,000,000 with an element from another periodic group to provide the proper *n* or *p type* conductance; and grow into crystals.

A minimum of experimentation, however, would quickly establish that the chemistry of preparing the super-pure materials and uniformly doping them to produce n-type and p-type semiconductors is one of the most intricate problems that inorganic and physical chemists have ever tried to solve. Not the least of the problem is that no reliable method has been developed to predict the energy gap; all possible combinations and proportions of candidate elements have to be prepared and the energy gap determined empirically!

In attacking this whole problem of semiconductor materials for advanced electronics, Monsanto research is focused on the following four areas of study:

1. PURITY IMPROVEMENT...
of "III-V" semiconductor compounds by at least one or two orders of magnitude over best purity yet available; and, concomitantly, studies of new techniques for converting these high-purity compounds into single crystals. When completed, a variety of new and improved electronic devices can be developed with these high-purity materials.

2. "SPOT" SYNTHESIS AND SCREENING...
of candidates in numerous classes of compounds for organic semiconductors—compounds where structural concepts point to the compounds' ability to shift electrons. (In organic semiconductors, too, uniformity and purity are vitally important.)

3. NOVEL CHEMICAL PROCESSES...
are under intense study for the preparation of compounds of group "II-VI" type semiconductors.

4. NEW INORGANIC SEMICONDUCTORS...
i.e. gallium and indium arsenides are now available for research and development. Doping of gallium arsenide is in progress.

A major purpose of this semiconductor chemistry research is to find materials with greater reliability over a wider temperature range, the ability to function at high temperatures, and variously with improved electrical, photoelectric, thermoelectric, magnetic, and photoconductance properties. By intensifying—chemically—the electronic property sought, improved devices based on these properties will become feasible. In collaboration with electronics manufacturers, the materials now on the horizon will serve in telemetry, automation monitoring devices, guidance computers, ignition systems, and communications equipment. These materials will also open the door more widely for increasing the efficiency of thermoelectric power generation, thermocooling devices, and photoelectric power generation. Promising leads are under study in "III-V" semiconductors of indium, gallium, and boron phosphides;* in new "II-VI" compounds and others.

(Please turn page.)

**F. V. Williams and R. A. Ruehrwein, J. Am. Chem. Soc., 82, 1330-2 (1960); D. E. Hill and B. D. Stone, Physical Review Letters, 4, 282 (1960).*

THE BROADENING SPAN OF CHEMISTRY FOR ELECTRONICS

Monsanto researchers have already produced a variety of unique materials chemically tailored for the particular needs of electronic engineers. These materials range from liquid dielectric coolants for "packaged" units to singularly pure, reliable-performance large crystals of meticulously doped silicon. Many more, however, like the following, are in various stages of development:

"III-V" INTERMETALLICS . . .
prepared by Monsanto Research include polycrystalline indium arsenide (now used in Hall-effect devices such as watt-meters) and both single-crystal and polycrystalline gallium arsenide for tunnel, parametric, switching, and Zener diodes.

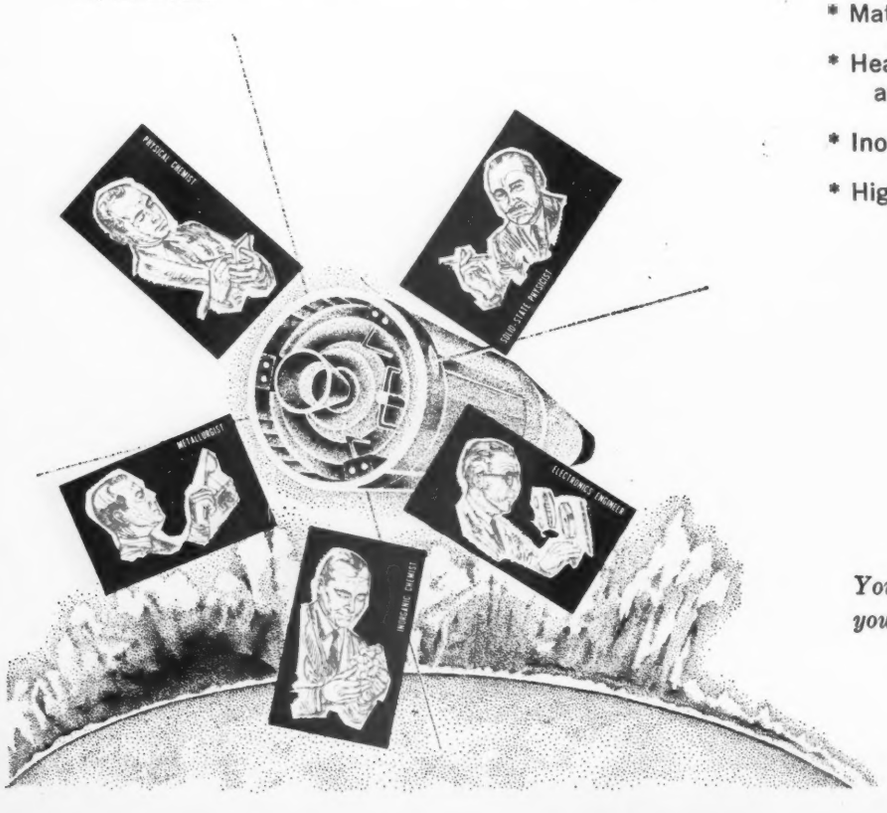
DISPERSION-STRENGTHENED NICKEL AND COPPER METAL AND METAL POWDERS . . .
are under study for corrosion-resistant electrodes, electrical contacts, and as high-strength, high-temperature core leads for electronic tubes and apparatus.

HIGH-STRENGTH CERAMIC ENVELOPES . . .
for vacuum tubes using specially developed fine mixed metallic oxides.

SEMICONDUCTORS AND SPECIAL COMPOUNDS FOR ELECTRONICS . . .

another chemical capability of Monsanto.

If your work requires special semiconductor materials; ultra-finely divided metallic oxides; electronic coolants; high-temperature potting compounds; or high-strength, heat-resistant conductors—you are invited to take advantage of Monsanto's explorations and experience in these fields. Write or call: Monsanto Chemical Company, Department 03-A Bldg., St. Louis 66, Missouri.



Monsanto Space-Age Projects for Government and Industry

* High-Temperature Hydraulic Fluids
* Coolant-Dielectrics for Electronic Equipment
* High-Temperature Plastics
* Improved Nitrogen Oxidizers for Solid Propellants
* Fire-Resistant Structural Plastics
* Hydrocarbon Fuels for Jets and Missiles
* Fire-Resistant Hydraulic Fluids for Ground-Support and Missile-Launching Equipment
* Radiation-Resistant Heat-Transfer Fluids
* High-Temperature Lubricants and Additives
* Radiation-Resistant Reactor Coolant-Moderators
* Intermetallic Semiconductor Materials
* Pure Silicon for Transistors, Rectifiers, Diodes
* Ultra-Fine Metal Oxides
* Materials for Vibration Damping
* Heat-Resistant Resins for Laminating and Bonding
* Inorganic Polymers
* High-Energy Solid Propellants

Monsanto

You are invited to work with Monsanto on your materials needs in the above fields.

Little Grains of Sand . . .

Gentlemen: Thank you very much for your response to my comment about the Almanac Issue ["Airmail," November '60] being a foreign intelligence agent's delight.

You, of course, are probably right i.e., "in a free society, dissemination of such information to the public serves a purpose far more useful than the possible advantages accruing to our potential enemies." At least this is the popular belief.

The compilation of many bits and pieces from unclassified sources frequently results in fitting together a complicated jigsaw puzzle that enemy agents have difficulty in solving. In addition, a compilation of unclassified material often ends up in something that should be classified upon completion.

I have great admiration and respect for our Chief of Staff. His comments are certainly sincere and appropriate.

As you say, there are two sides to every coin. But I know, from experience, that we have handicapped the free world—significantly—in our eagerness to disseminate valuable information in open publications.

Brig. Gen. John M. Schweizer, Jr.
USAF (Ret.)
Paris, France

X-15 Pilots

Gentlemen:. . . There is just one thing in Jules V. Bergman's story ["The Road to Beyond," October '60 issue] that is slightly incorrect. He notes that Joe Walker will be flying the X-15 in the speed regime and that Bob White will fly the altitude side of the program. Although this did happen with the XLR-11 engines, this will not be the case when the XLR-99 engine enters the program. Actually, both men will alternate flights; first in the speed regime in order to determine control characteristics, high speeds, thermodynamic heating, etc. Having acquired some data and experience at high speeds, they will both then conduct research flights which will carry the aircraft to high altitudes.

Having two pilots of equal experience assures that the program can continue without interruption if one gets an ingrown toenail or something like that.

Col. Charles A. Brown
Director of Information
Edwards AFB, Calif.

SAC on the Road

Gentlemen: I have just completed reading "Working on the Railroad . . . SAC Style" [October issue] and must say that it is one of the most interesting articles ever published by AIR FORCE/SPACE DIGEST.

Please permit me to commend TSgt. James R. Doherty. He did an excellent job of describing the trip, and the photographs that accompanied the article made it complete. . . .

Virgle G. Wells
Cleveland, Tex.

Raise Your Hands

Gentlemen: I would like to see AFA or AIR FORCE/SPACE DIGEST sponsor a series of folios of reproductions of our famous military aircraft, these reproductions, preferably paintings, to be suitable for framing and display. I have in mind the series that is displayed in the Douglas plants, and I am sure other companies have similar art from advertising or from displays. One of the oil companies, I believe, had a series from World War I. I would like to have reproductions of more than thirty aircraft from World War I on, and beyond that I would like to have a folio of famous aviators also. Perhaps such folios could be subscribed to by members, and I can think of many good reasons why they might buy same.

My second suggestion is a group of color slides of today's aircraft with text which could be used for lectures and for educational programs, followed by a missile series.

Meantime, the 1960 Almanac is great—and very useful—and just about the best reading anywhere.

Guy H. Nicholson
Sepulveda, Calif.

● *Past experience shows that the volume of interest would not be high enough to support such an expensive project. How about a show of hands?* —THE EDITORS

History Notes

Gentlemen: We are compiling an official history of the New York Air National Guard. Any information about the early days of the organization, particularly about the Aviation Detachment, 1st Battalion, Signal Corps, New York National Guard and the later 1st Aero Company of the same unit, would be deeply appreciated.

Don Anderson
Office of Information Services
New York Air National Guard
Westchester County Airport
White Plains, N. Y.

Gentlemen: I should like to contact former Air Force veterans who took part in the invasion of Holland during World War II for the purpose of researching for a book.

Clarence F. Montgomery
686 Buttonwood Street
Long Branch, N. J.

Final Authority

Gentlemen: After a frantic search through our dictionaries and reference books to find the correct spelling for the word "astronaut," Arthur Joy of our Technical Publications Department offered the missile and space glossary published in your April 1960 issue as a final authority.

We have since found that this glossary is an excellent supplement to dictionaries that do not carry these relatively new terms in our language. . . .

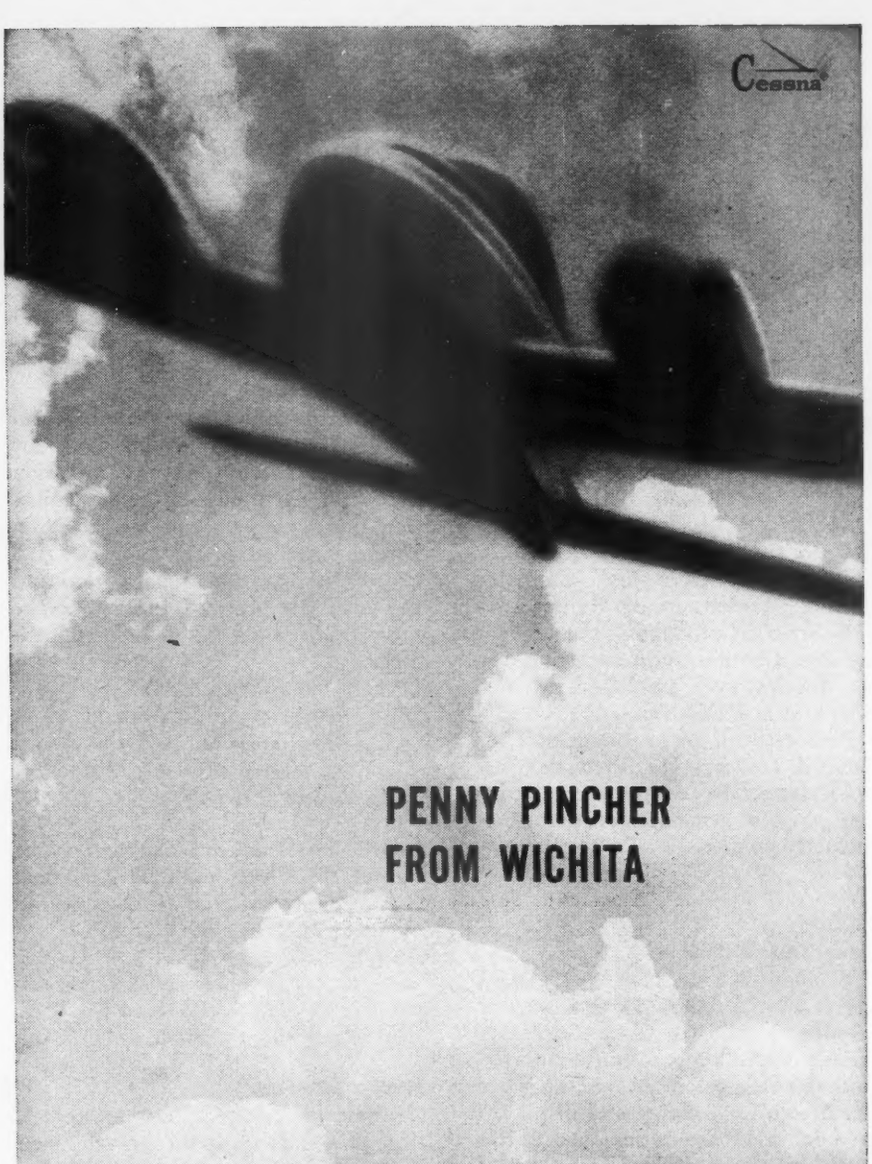
Betsey B. Dickinson
Raytheon News
Raytheon Company
Waltham, Mass.

In Spite of Everything

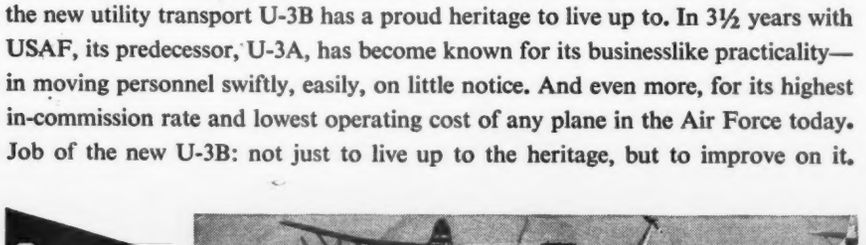
Gentlemen: Here are my objections to AIR FORCE/SPACE DIGEST. As a nonparticipating member of AFA naturally I have no bone to pick with *them:*

a. Too much technical writing.
b. Not enough information regarding AAF history, groups, squadrons, air forces, wings, divisions, etc.
c. Too much advertising.
d. Printing too small.
e. Not enough pictures (color).

(Continued on following page)



One of many new ways the Air Force will save money this year: Cessna U-3B To join the Air Force soon, the new utility transport U-3B has a proud heritage to live up to. In 3½ years with USAF, its predecessor, U-3A, has become known for its businesslike practicality—in moving personnel swiftly, easily, on little notice. And even more, for its highest in-commission rate and lowest operating cost of any plane in the Air Force today. Job of the new U-3B: not just to live up to the heritage, but to improve on it.



World's most experienced makers of utility military aircraft

f. Should be readable to airmen of the future (teen-agers).

g. Too much accent on space (we are not all graduates of MIT).

Sign me up for another year.

Roy W. Carlson
Norfolk, Mass.

They Do Creep In

Gentlemen: I sincerely hope that I'm not the first to advise you of a gross error in your September '60 issue!

The B-57 is *not* phased out of the active inventory. One of the oldest, best, and most active Air Force units—3d Bomb Wing—is still equipped with this aircraft.

We have no objection to being considered an ANG unit, but I'm wondering which name would be most appropriate: Emperor's Own, Honshu Mavericks, or O'Donnell's Punch?

Col. Robert J. Ahern, Commander
Hq. 3d Bombardment Wing (TAC)
APO, San Francisco, Calif.

● *Sorry. We cross-checked with three sources not, obviously, including the 3d Bombardment Wing. Thanks for correcting the record and apologies to the men of the 3d*—THE EDITORS

Gentlemen: The September issue of AIR FORCE/SPACE DIGEST arrived and once again another fine job was accomplished by AFA in its annual "Air Force Almanac."

The USAF aircraft inventory was of particular interest to us in Air Rescue Service, mainly due to several errors.

First of all, ARS has in its inventory the SA-16B Albatross, not the "A" model which was described. **Wing span:** 96 ft. 8 in.; **height:** 25 ft. 10 in.; **maximum allowable airspeed:** 292 mph; **maximum gross takeoff weight:** 36,000 lb.

Secondly, the SB-29 has not been in service in Air Rescue Service since 1955. The primary Rescue aircraft is currently the Douglas SC-54D Rescuemaster. **Contractor:** Douglas; **power plant:** 4 Pratt & Whitney R2000-4 piston engines; **dimensions: wing span,** 117 ft. 6 in.; **length:** 96 ft. 6¾ in.; **height:** 27 ft. 10 in.; **maximum allowable airspeed:** 323 mph; **ceiling:** 30,000 ft.; **crew:** 6 or 8; **maximum allowable gross weight takeoff:** 73,000 lb.; **primary using command:** MATS, ARS.

Here at Prestwick, Scotland, we were also surprised to see Prestwick AB, Scotland, omitted from "United States Air Force Installations Overseas," on page 231.

1st Lt. Jack H. Oswald,
Det. 1, 57th ARS (MATS)
APO, New York, N. Y.

He solved this puzzle by taking it apart!

Like oil and water, extreme precision and "complete" mobility resist combination in tracking radar antennas. Designing for one of these characteristics "automatically" precludes the other. *That* was this AMF Engineer's puzzle—to put *both* precision *and* mobility in an antenna for duty with the Marine Corps.

He solved the puzzle, literally, by taking apart the solution—AMF's TPQ-10 antenna—into 10 rugged, portable, submersible, precision-fabricated packages. TPQ-10 is designed for helicopter transport. Each component can be dropped in water; it will come up for more. The packaged antenna on its pallet can be dropped on land from 3 feet without impairing precision.

Each component can be *picked* up—the largest weighs 425 lbs.—and can be handled by 3 men. A crew of 6 can put TPQ-10 together in 20 minutes with one standard wrench.

Among the design innovations that solved the puzzle is a "piggy-back" gear arrangement that puts both azimuth and elevation drives in one package. Result: almost half the parts and weight of separate components. Precision fabrication is typified by the reflector arms, held to a .005" deviation over 45 inches!

(For unclassified information on early warning and radar antenna systems, write Dept. CS 1, address below.)

Single Command Concept

Solving puzzles with next-to-impossible conditions is AMF's business. AMF's imagination and skills are organized in a single operational unit offering a wide range of engineering and production capabilities. It accepts assignments at any stage from concept through development, production and service training, and completes them faster... in

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- *WeaponSystems·UnderseaWarfare*
- *Automatic Handling & Processing*
- *Range Instrumentation • Radar*
- *Space Environment Equipment*
- *Nuclear Research & Development*

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Each display exhibits up to 12,800 symbols . . . alphanumeric, schematic, map, graph, chart and other arbitrary or abstract data . . . individually or simultaneously. The flicker-free tubes retain images for at least 20 minutes and provide for multiple superimposition of data. Erase time is less than a second.

Detailed information on the RD-900 System is available upon request.

LFE

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What's New With ★ RED AIRPOWER

Here's a summary of the latest available information on Soviet air intelligence. Because of the nature of this material, we are not able to disclose our sources, nor document the information beyond assurance that the sources are trustworthy.

The Russians have not yet been able to develop satisfactory solid fuels for their large missiles. Their use of solid missile fuels is limited to small air-to-air, air-to-ground, and ground-to-ground barrage missiles. Now comes word that even the intermediate-range missiles aboard Soviet submarines use liquid fuels. The fuel must be very difficult to handle within the confines of the undersea craft. Nitric acid is the basic fuel component, according to these reports. Apparently the Russians have found a way to store it inside the missile while the submarine is at sea. Nitric acid also is used in some of the Red Army's short-range, motor-carried missiles.

The Air Force's second-generation Minuteman ICBM and our Navy's Polaris both, of course, use solid fuels.

° ° °

Many details were absent from the initial Soviet announcement of Sputnik V, animal-bearing capsule of which was recovered back in August. Here are further facts now available on Russia's "Zoonik":

First, the flight, according to the Reds, was slowed from orbiting speed by a series of carefully timed and regulated retrorockets.

Second, Sputnik V was a winged vehicle that had an arrowhead shape.

Third, the landing was in the Soviet Union's Kara-Kum desert, which has large dry lake beds similar to those found in our own west. One of these in the US is Muroc Dry Lake at Edwards AFB, Calif., prime US test center.

In addition to two dogs, forty mice, two rats, fruit flies, fungi, and a blooming plant on board, Sputnik V carried equipment to measure cosmic radiation and to determine whether radiation levels encountered would permit human life. Ultraviolet radiation also was measured. Film was used for some of this work. Part of the film was developed while the vehicle continued to orbit, thus preventing contamination of exposed film by later radiation.

Quite likely Sputnik IV, Sputnik V, and the most recent Pacific Ocean shots were powered by the same rocket engines. Power developed by these two-stage rocket engines is believed to be on the order of 800,000 to 1,000,000 pounds of thrust.

° ° °

The Russians have been writing about how they can interfere with our Tiros, Discoverer, and Samos satellites when they fly over the USSR. *Red Star,* the Soviet Army newspaper, recently stated that such satellites are vulnerable to communications interference. Also, it said "anti-rocket missiles sent to the satellite's orbit may intercept them in flight," indicating the Russians already are at work on antisatellite rockets, and perhaps anti-ICBMs.

° ° °

Ghana has increased from four to ten its orders for IL-18 turboprop transports from the USSR. Four are for airline use, six for the Ghanaian Army. Cost per plane remains unrevealed. The USSR recently extended a $40 million credit to Ghana.

A fuel-injection problem was behind the grounding of IL-18s, according to Federal Aviation Agency Administrator Elwood R. Quesada, who visited the USSR recently.

The grounding did not affect Czech IL-18s for long. CSA, the Czech airline, returned its IL-18s to service in short order. The Czechs are understood moving toward introduction of the airplane on a European-Canadian route as soon as arrangements can be made.

° ° °

Moscow's new commercial airport, Sheremetievo, has the longest nonmilitary paved runway in Russia. It is 11,500 feet long. Sheremetievo also has a long approach lighting system that extends at both ends farther than the length of the runway. The single strip has the first adjustable runway lights known in the Soviet Union. Sheremetievo has joined Vnukovo as main fields serving the Red capital.

° ° °

US experts back from the Congress of the International Federation of Automatic Control in Moscow report that the Russians were amazingly aware of US work in automation. US representatives were quizzed closely by the Russians. The Russians are themselves devoting considerable attention to work in this field.

The extent of Russian knowledge of US developmental work is attributable to Russia's very efficient translation service, which prepares about 600,000 reviews of foreign technical papers and trade journals per year. These are circulated to top-level scientists and technical institutes. Recipients check items of interest, send in the lists, and receive complete translations. The summaries and translations are prepared under the auspices of the Academy of Science's All-Union Institute of Scientific and Technical Information.

° ° °

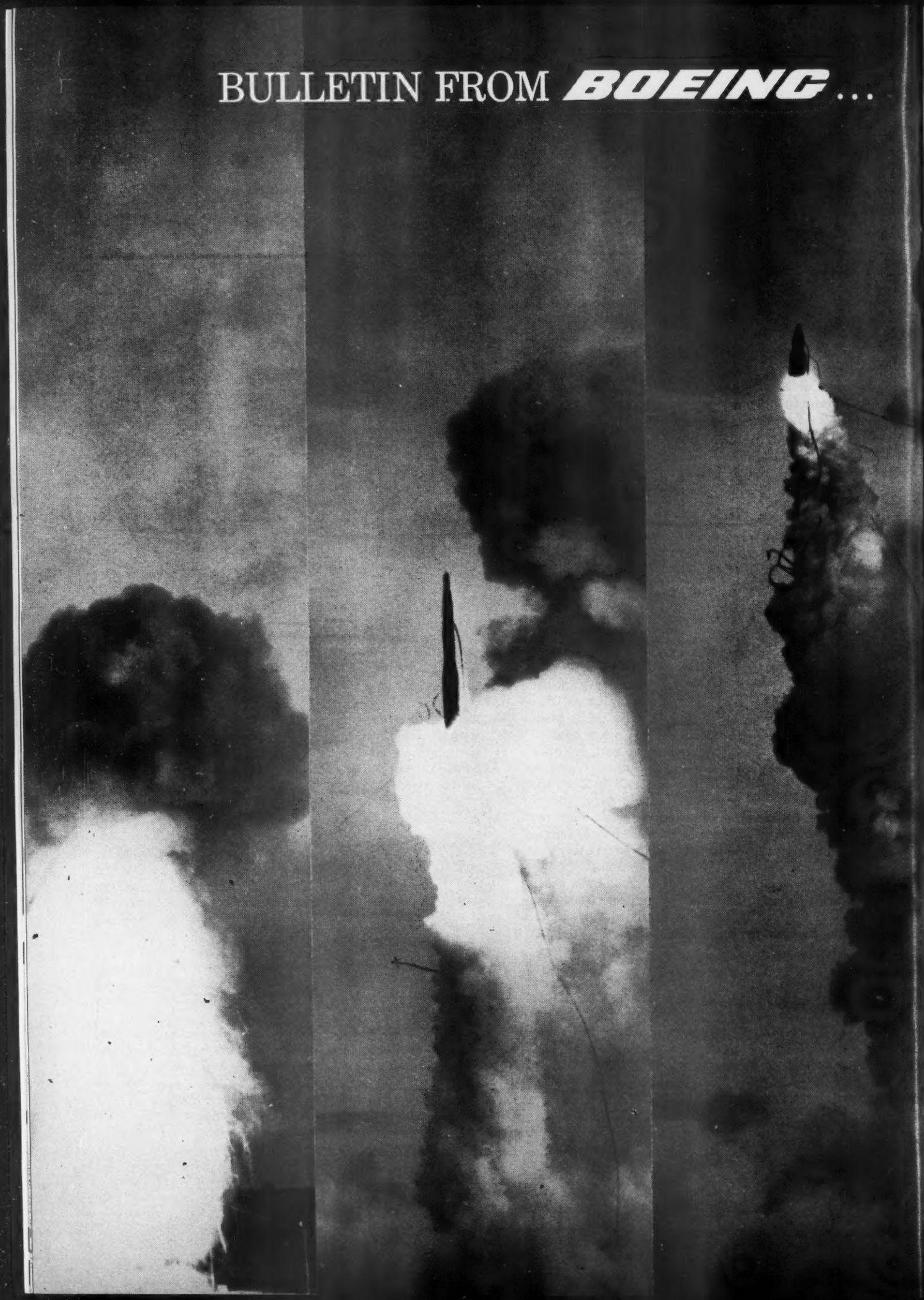
The first plastic reinforced with fibrous glass noted by western observers in the USSR was in the plastic body of a racing car about three years ago. Now, however, the material has found its way into the aircraft industry. The new AN-24 local-service turboprop employs it in trim tabs and to cover flush-mounted antennas. The material also is believed used in air-to-air missiles of the Red Air Force.

° ° °

More and more Soviet experts are showing up in Cuba. Some of the experts are called geologists. They spend their time going over the Cuban countryside—but whether they are carrying on geologic survey work or studying the country from a military standpoint remains a question. The Soviets and the Czechs have experts in Cuba instructing the Cuban armed forces in tactics and weapons.

° ° °

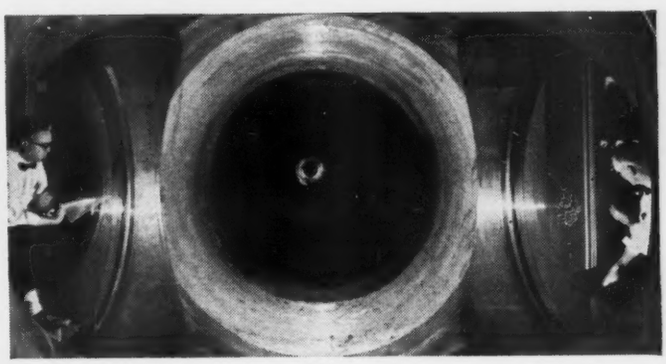
If true, Soviet statements of the performance of the new TU-124 turbofan-powered jet transport show rather remarkable improvement over all previous Soviet jets for commercial use. The TU-124, which can handle up to sixty-eight passengers in an economy configuration, gets off the ground after a run of 2,700 feet and can operate regularly from 5,000-foot runways. With this jet it will be possible to operate from a great many airfields in Russia without having to add any hard surfacing beyond that already available for MIGs.—END


BULLETIN FROM BOEING...

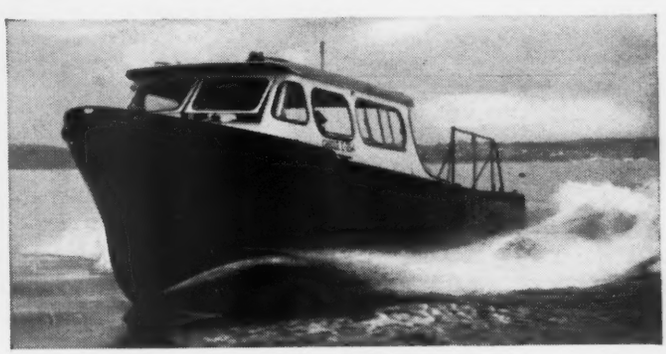
..WHERE CAPABILITY HAS MANY FACES

Minuteman, the nation's first solid-fuel ICBM, blasts from underground silo, left, in tethered firing test. Successful Minuteman firings cut test program, saving millions of defense dollars. Boeing is weapon-system integrator of the 6000-mile-range Minuteman missile, now under development.

FLYING COUSINS. You can cross a continent or an ocean in brief hours by Boeing jetliner, then fly to local airport or center-city in a helicopter built by Boeing's Vertol Division. Vertol helicopters are flown by the U.S. Air Force, Army and Navy as well as by the commercial carriers and armed services in many countries. Boeing 707s and 720s—most proved jetliners in the world—have already carried more than 10,000,000 passengers.



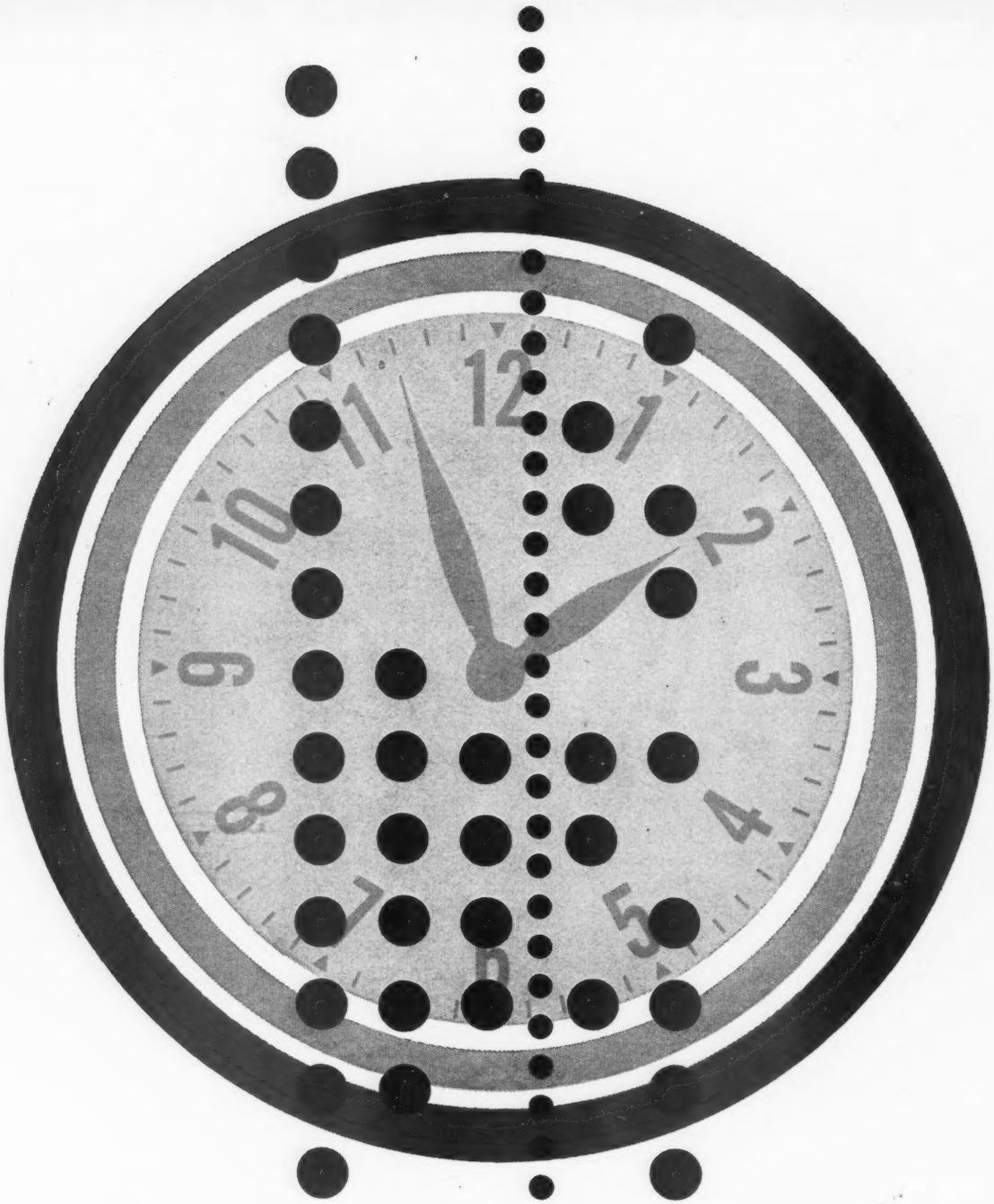
HOTSHOT TUNNEL. Here, in largest privately owned wind tunnel facilities in the world, future aircraft, missile and space-vehicle models can be tested at speeds up to 18,000 miles an hour. Many space-flight conditions can be simulated during tests. Decades of emphasis on research have enabled Boeing to pioneer nation-benefiting advances in vital areas of manned and unmanned flight.



SEAGOING TURBINES. Boeing gas-turbine engines power this high-speed oil company personnel boat as well as U.S. Navy minesweeping launches and landing craft. Light, powerful, compact Boeing shaft-drive turbines have scored many firsts: first turbine to power highway truck, fire engine, helicopter, locomotive and light airplane. Boeing turbines also serve in jet-engine starters used by U.S. Air Force and commercial airlines.

BOEING

JET AIRCRAFT, MISSILES, HELICOPTERS, TURBINES, WEAPON-SYSTEM MANAGEMENT, SPACE-FLIGHT VEHICLES AND SYSTEMS.



TAPE AND MICROSECONDS are essential to missile development.

Precision instruments measure and record every function against time... often to greater accuracy than 10^{-4} seconds. Reams of electronic and optical data must be collected, reduced and evaluated before any missile can become operational. Vitro designed, built and helped instrument the Air Force missile test center at Eglin Air Force Base, Florida. Today it operates the center's test ranges and tracking stations throughout the Southeast. At Eglin, Vitro and the Air Force, working as a team since 1952, are responsible for checkout of missiles, rockets, weapon systems, countermeasures, space probe vehicles and bombing techniques. Vitro has built custom-engineered digital data handling systems for computer multiplexing, timing, data transmission, ECM evaluation and many other applications now used at Eglin and other DOD test ranges.

SCIENTISTS AND ENGINEERS: JOIN THIS TEAM.

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AIRPOWER in the news

Claude Witze
SENIOR EDITOR

Placing Brick on Brick

WASHINGTON, D. C.

Even as Americans were exercising their franchise last month and sending Senator Kennedy to the White House, Moscow was the scene of a new love feast, with the Chinese Communists hailing Russia for its leadership. Nothing, said a message from Peiping, can shake the "monolithic friendship and solidarity of the Soviet Union and China." The news received scant attention, as did a great number of other developments during the presidential campaign.

While the preelection battle was taking top headlines in the weeks before November 8 it was clear to those who read *all* the news that the cold war was raging unabated. Cuba has become what, with no exaggeration, must be called a Communist satellite. Arms are pouring in from Soviet sources, and the real pessimists say the island may become a jumping-off place for the Red effort to convert malcontents in Latin and South America. The New York *Times,* which is one of the more enterprising newspapers of the country, sent a reporter into northeast Brazil. He found 20,000,000 miserable people being organized and indoctrinated by Communists. Their heroes are Fidel Castro and Mao Tse-tung. Their top leader, laying plans to extend the movement into southern Brazil, now is visiting in Communist China.

The Congo situation is growing worse instead of better. In Algeria the French are making no progress, but there are signs that the Communists are moving ahead to the point where some feel there might be another Korea in the making. Berlin remains a tinderbox and one that could be touched off this winter. Laos feels the tightening of the Red grip. In Great Britain there is a growing sentiment for neutralism, encouraged by England's left-wingers. While we were watching two candidates hedge-hop around the country there was a row in London over the announced plan to have US Navy Polaris-type submarines serviced from a base in Scotland. The pacifist wing of the Labor Party, which doesn't like anything American very well, is expected to capitalize on the situation at every opportunity.

All of these things, and more, come under the heading of unfinished business faced by Mr. Kennedy as he moves this month toward the White House. Except for some slips in the heat of the fight when he was called an "economic ignoramus," nobody has seriously challenged his determination to tackle this business with dispatch. After a few years in which the nation, and, indeed, the Republican Party, has developed an unquenched thirst for real leadership, there is hope here of an improvement. Even the New York *Herald Tribune,* which supported Mr. Nixon, says the next President is a "man of intelligence, stamina, and patriotism." It says this, however, after calling Mr. Kennedy's campaign "history's most shrewdly staged and adroitly waged." The newspaper says he planned his steps to the presidency "as methodically and unsentimentally as a mason places brick on brick."

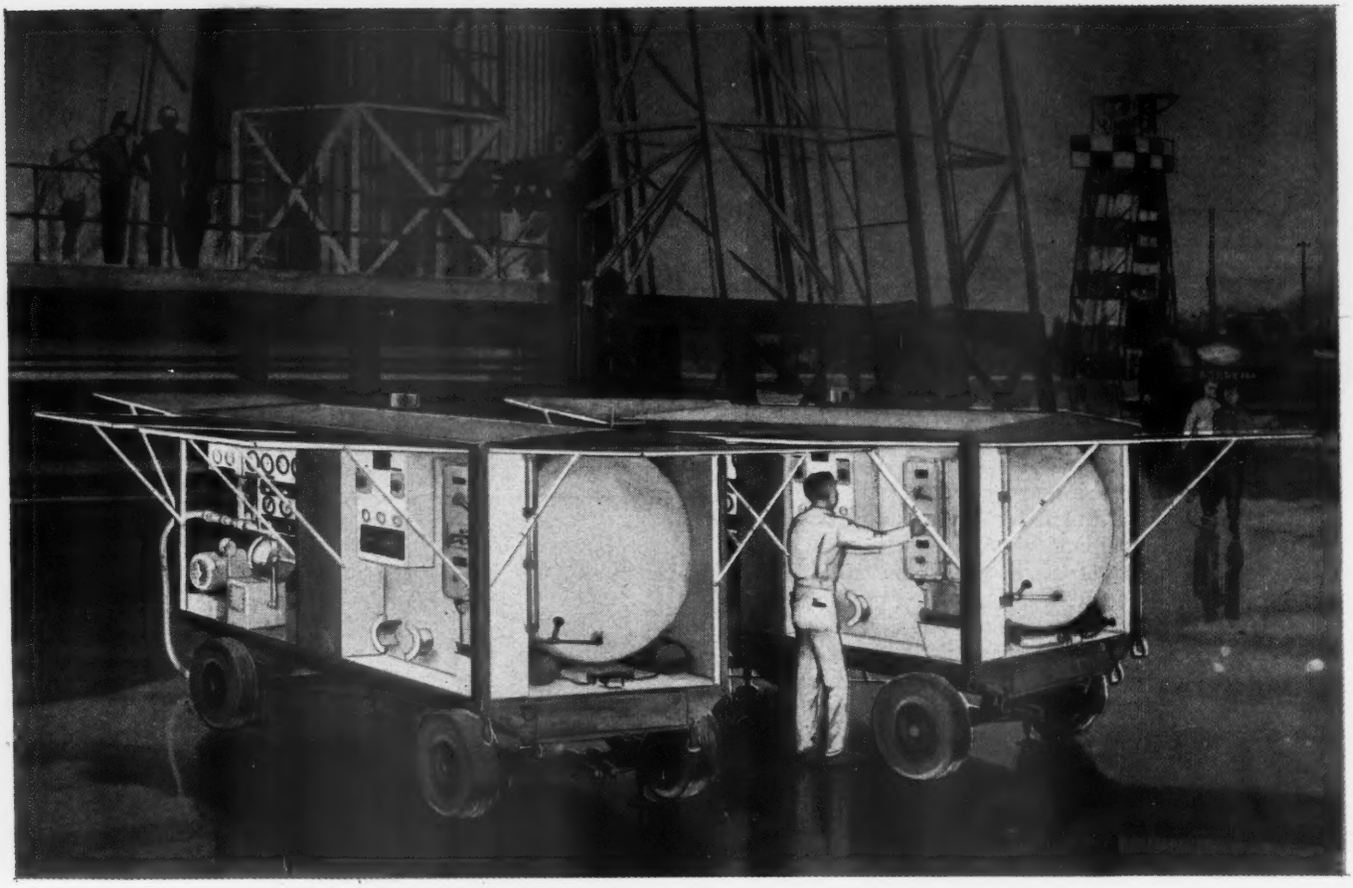
President-Elect John F. Kennedy. National defense issues, international crises will offer him host of challenges.

Somebody, it seems, should submit that these talents have merit. Look at the unfinished business, here and abroad, from the farm problem to national defense and the import of the Communist summit meeting in Moscow. Certainly it constitutes good building material to be worked by someone capable of shrewdness and adroitness, of methodically placing brick on brick. The *Herald Tribune,* at least by implication, seems to sneer at the Kennedy effort leading to the White House as that of a competent politician. Well, in the light of the available documentation on our more recent efforts in foreign and domestic matters, isn't it possible that a competent politician is just what America needs?

Men Around the White House

Before President Kennedy replaces President Eisenhower there will be a White House budget message sent to Capitol Hill for fiscal year 1962. There are indications that the new Chief Executive has no intention of merely defending recommendations made by the old one. Mr. Kennedy's top advisers are reported in favor of having a Kennedy budget on hand and getting it up to Congress as quickly as possible. It may be that the transition machinery worked out in cooperation with the Eisenhower Administration will

(Continued on page 23)



HOW FMC's CHEMICAL AND MECHANICAL EXPERIENCE SOLVES MISSILE PROPELLANT PROBLEMS

Food Machinery and Chemical Corporation, through its integrated divisional operation, offers a unique capability for the design and production of missile propellant handling equipment.

FMC's chemical background covers years of research, development and production of toxic fuels, including high-strength hydrogen peroxide and Dimazine® (UDMH). Utilizing this extensive experience, FMC's Ordnance Division has developed many new processes, systems, and equipment for use in solving critical problems in the handling of missile propellants; among them high-accuracy metering equipment, and the Bomarc decontamination system.

For more detailed information on these studies and for experienced counsel on missile fueling problems, contact FMC, a leading developer and producer of chemical propellant compounds and the equipment to handle them.

For further information, write on company letterhead to Preliminary Design Engineering Dept., FMC Ordnance Division, P.O. Box 367, San Jose, Calif. Phone CYpress 4-8124.

Putting Ideas to Work

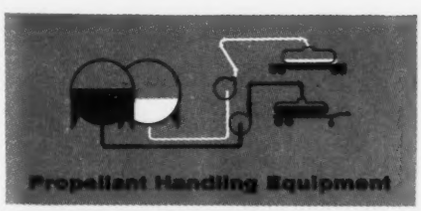
FOOD MACHINERY AND CHEMICAL CORPORATION

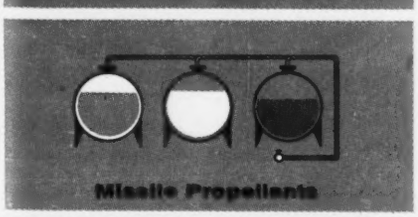
Ordnance Division

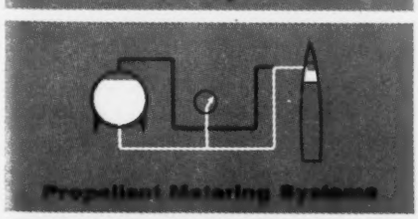
1105 COLEMAN AVENUE, SAN JOSE, CALIF.

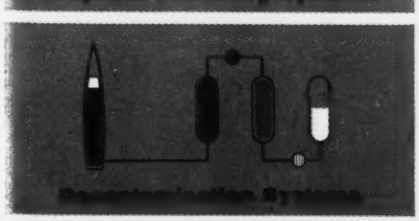
fmc

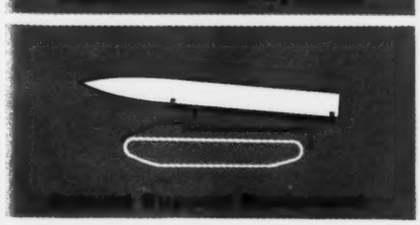
Illustrated below are some of the activities of FMC concerned with missile propellants and propellant handling equipment, which help define a few of the problems successfully solved by utilizing the combination of chemical and mechanical engineering talent available.



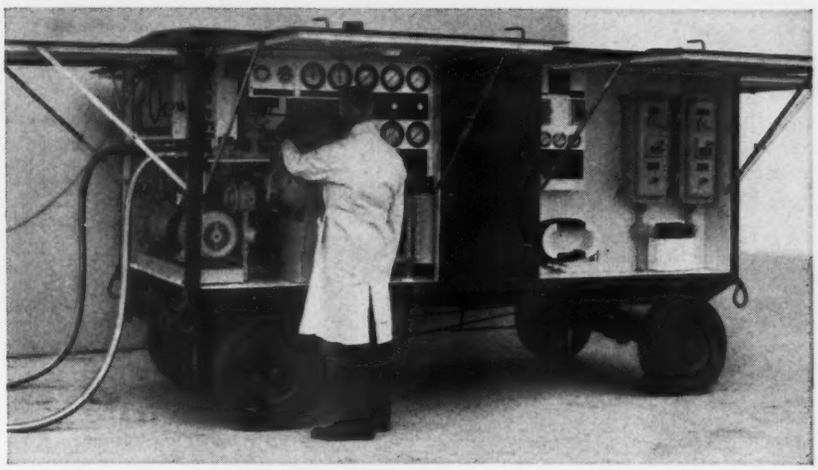








FMC's New Liquid Propellant Metering System Achieves Accuracy to ±0.1%



Mobile metering and control unit for fueling liquid propellant missiles.

The crucial reliability of multistage missiles is influenced by the accurate measurement and delivery of liquid propellant to the missile tanks. For example . . . a small error in fuel weight could adversely affect the in-flight performance of the missile, causing possible failure of the entire mission.

Food Machinery and Chemical Corporation's Ordnance Division has recently developed a mobile liquid propellant metering and handling system which promises to solve many missile fueling problems. The advantages offered by this unique new system are many.

Accurately measures and records the amount of fuel delivered to the missile tanks. Original specifications called for a metering accuracy of ±0.2%. Extensive tests, recorded by precision test equipment, show that the system is capable of metering and delivering missile propellants with far superior accuracy—to ±0.1%.

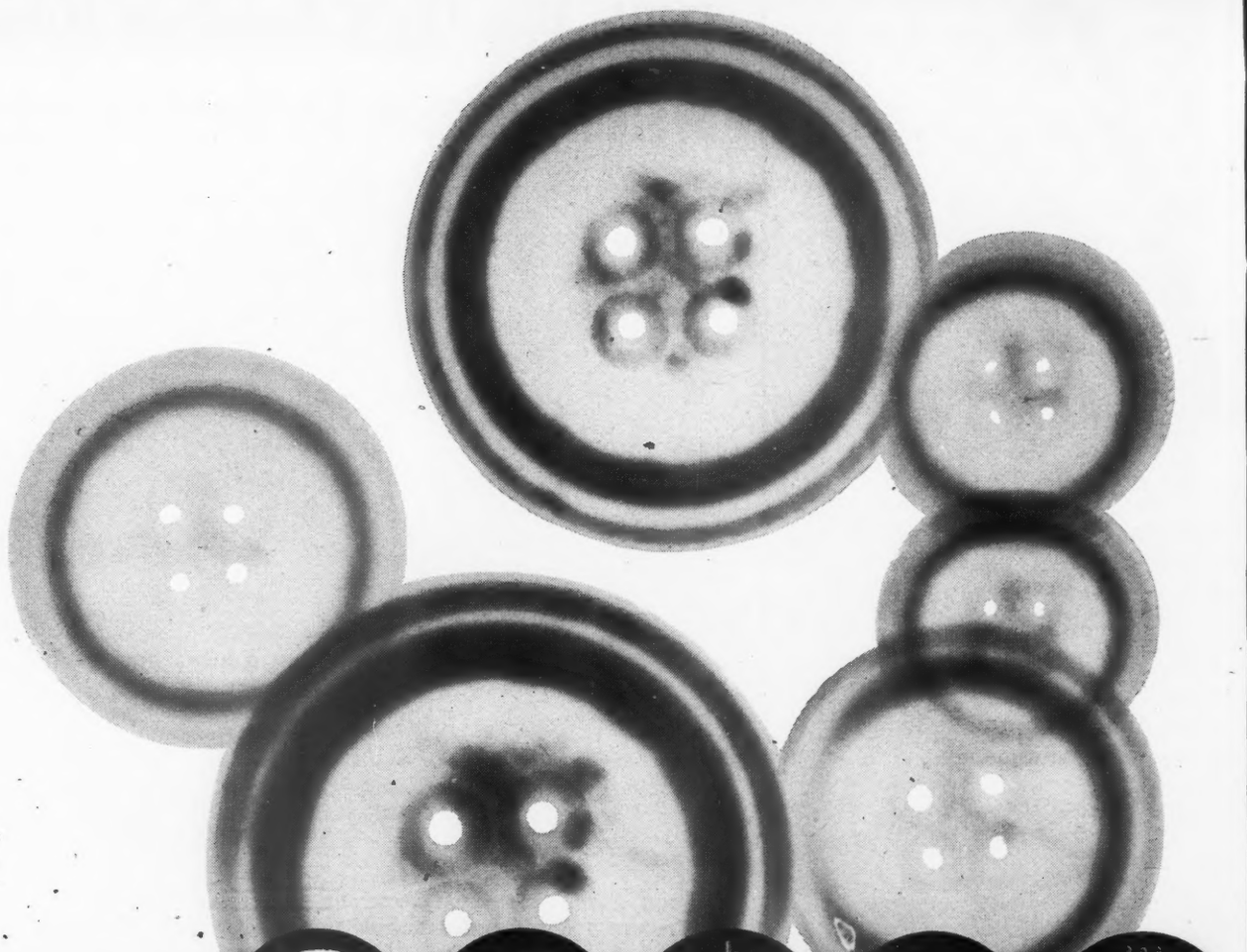
Automatically compensates for factors influencing fueling accuracy. The fuel is continuously sampled and the flow corrected for variations in temperature and density. In addition, the fuel which vaporizes in the missile tanks is returned to the system, condensed, measured, and an equivalent amount added by the metering unit.

Adaptable to many different missile fuels. The system is designed to handle such storable liquid propellants as hydrazine, nitrogen tetroxide, Dimazine® (UDMH) and nitric acid.

Economical to manufacture and safe to operate. To reduce development, manufacturing and operating costs, the system makes maximum use of standard, interchangeable, and commercially available components. The simple and safe design eliminates human errors and danger to operating personnel.

Mobile and compact. All metering, pumping and control equipment is mounted on a single, portable trailer. The complete unit may be easily transported, rapidly positioned, and provides a single station for the monitoring of fueling operations.

The successful development of this mobile metering and handling system by the engineering staff of FMC's Ordnance Division is another achievement made possible by utilizing the unique combination of chemical and mechanical engineering talent available at Food Machinery and Chemical Corporation.



ON THE BUTTON

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make this unnecessary, that there is a better way than the introduction of two budgets.

Even before the campaign got under way Mr. Kennedy had major staff projects under way to prepare for this situation. It is clear that the new Administration knows as well as the old one that it is the budget, primarily, that carries out policy. There also are signs that the policy, starting in late January, will be determined by a strong President. Attention here should be directed at the opinions of Paul H. Nitze, President of the Foreign Service Educational Foundation, a former State Department policy planner, and an adviser to the Gaither Committee. Mr. Nitze appears to be in charge of the Kennedy staff effort in the areas of defense and foreign policy. Less than six months ago this man was a witness before Senator Henry M. Jackson's inquiry on national policy machinery, which has been one of the more sophisticated and profitable quizzes under way in 1960. Mr. Nitze appeared one day after President Eisenhower's visit to Japan was canceled. He didn't mention the word *prestige,* which was kicked around unmercifully in October, but he made it clear that leadership and not mechanics is what determines our national image.

What we must do, said Mr. Nitze, flows from what we are. The solution to our problems, he believes, must come from "values inherent in our nationhood and in our concept of human dignity. The whole society is custodian of these values. The defining of what they impose on us in relation to our environment falls, above all and essentially, *to the President.*"

He continued with this concept:

"I do not mean just an office. I mean also a man and his full attention. The appreciations necessary to the strategic conception which is the basic element of our policy cannot be achieved by intermittent attention. They cannot emerge from briefings designed to reduce all complexities to a nutshell. They cannot be arrived at through policy papers designed to cover up dilemmas and smooth over the points of crux. The job cannot be merely distributed among subordinates."

What Mr. Nitze further urges to complete the change in approach at the White House is a new exercise of the power of the office:

"If this central requirement of presidential leadership and executive energy is not fulfilled, it is difficult to the point of impossibility to redress the lack at other points. A thousand committees may deliberate, 10,000 position papers may issue, and the bureaucratic mills may whirl to unprecedented levels of output in memorandums, estimates, and joint reports—but little will come of it all if the exercise of the central authority vested in the President is faltering, intermittent, or ambiguous. . . .

"The task of seeing that the major policies form a consistent whole, congruent with the strategic concept determined upon, requires continuous superintendence that again must fall mainly to the President's responsibility. . . ."

If this is representative of the thinking around President Kennedy, and it almost certainly is, we can expect prompt refutation of the idea that our Chief Executive is not a leader and is not in a job requiring political acumen. It is the "President's will" that determines policy and carries it out, Mr. Nitze contends, and the organization is there to help him do it. As for the man, in addition to acumen he needs only two other things: intellectual honesty and a capacity for hard work.

Mr. Nitze's connection with the Gaither Committee taught him some things about that approach. These studies, he said, sometimes are used as a substitute for responsibilities that only the President can take. They are a way of dodging responsibility instead of a way of getting good advice and then using it in the exercise of responsibility. He clearly hopes that another Gaither Committee would see its report issued for public discussion and, more important, that its report would result in action. Action is a presidential responsibility.

Because he was in a top position on the preelection Kennedy staff, Mr. Nitze can be expected to prevail in many areas. But he is not alone. A more frequently mentioned name around Congress and in the Pentagon is that of Stuart Symington, the Democratic Senator from Missouri

Paul H. Nitze, important staff aide to Kennedy in defense and foreign policy matters.

and former Secretary of the Air Force. An experienced critic of defense policies in the Eisenhower Administration, Mr. Symington heads a committee studying Defense Department reorganization for the new President. He took this job knowing in advance that Mr. Kennedy, himself a Navy veteran, does not look with favor on the idea of a single uniformed service. His committee is expected to have a report, offering suggestions of a different nature, before the first of the year.

The men serving with Symington all are attorneys, many with experience in some part of the Pentagon and offering some kind of alertness to its problems. One is Clark Clifford, who was a White House counsel in the Truman Administration and may appear there again within a month. Another is Thomas Finletter, former Secretary of the Air Force and author of the famous Finletter Report on airpower, a document that at least was made public, even if it did not achieve necessary executive action from then-President Harry Truman. Roswell L. Gilpatric, once Under Secretary of the Air Force and now board chairman of Aerospace Corporation, is a member. Mr. Gilpatric's name is mentioned almost as often as that of Senator Symington as a candidate for Secretary of Defense in the Kennedy Cabinet. He was a member of the Rockefeller Special Studies Project. Two other members have a close relationship to Senator Symington. One is Fowler Hamilton, who was counsel of Symington's Airpower Investigation in 1956. He has been a member of the Joint Intelligence Staff of the Joint Chiefs of Staff. The other is Marx Leva, a law partner of the senator, who was a special assistant to the Secretary of the Navy and general counsel to the Secretary of Defense in the Truman Administration.

(Continued on following page)

If there is one thing all these men have in common it is a conviction that America has not been doing its best. And one man with whom they share this conviction is John F. Kennedy. In fact, if the new President has a mandate from the people at all it is an order to lead us to a better effort in the conflict with communism. Of course there are plenty of commentators who are saying the vote in November was so close that it cannot be interpreted as a mandate. If that is the case, there was a mandate in 1952 and 1956. If it had been carried out, the men around Mr. Kennedy, Nitze, Symington, Gilpatric, Finletter, and their associates, would not be concerned about the peril to the free world.

We Can Afford What We Need

There is no way, at this writing, to estimate how Mr. Kennedy and his advisers will view the Eisenhower defense budget for fiscal 1962. Rep. George H. Mahon, who is the master of defense arithmetic for the House Appropriations Committee, expects that the department's budget will climb by a billion or two. If the new obligational authority of the fiscal 1961 budget were increased by five percent, this would absorb that much money with great ease.

So far as the Air Force is concerned, it is evident that Mr. Kennedy's advisers include some of the men who have been critical of the effort in the past eight years. For the most part, they are men who have spoken up to challenge our capability as any more than marginally acceptable. None of them has denied that USAF is stronger than it was in 1950 or 1955. But they have questioned whether or not even this is enough. Those who have had a hand in such projects as the Gaither and Rockefeller studies are wary, to one degree or another, of Russian capabilities and intentions. They realize, as does USAF, that the Red bomber threat is a continuing one and that Moscow's ICBM arsenal will grow bigger. Soviet efforts have not abated in the search for better manned systems, and they have not been handicapped by any moral objection to the utilization of talent for the military space effort. In the face of this, recent economy measures have cut USAF's short-term capability, stretched its modernization program beyond an acceptable limit, and seriously impeded the research effort that will provide a force in being for another year. Even as we have been electing a President there have been more signs of increased Communist pressure in international relations, signs that have appeared in Cuba, Algeria, Europe, and the Far East. The potential enemy and source of this pressure has maintained and modernized its own forces at home, in Europe, and China. Its strategic capability is growing.

The defense budget exercise, for USAF, is one that starts with an estimate of what new obligational authority is needed to maintain a balanced program, adequate readiness, and proper activity in the research and development area. In fiscal 1961 the figure was a little less than $18 billion. If this were raised by a five percent formula, which is not the right way to determine what we need and how much it costs, the FY 1962 budget should call for at least $18.75 billion. Actually, a balanced program in view of the deficiencies created in recent years, would cost in excess of $19.5 billion. In the opinion of many observers even this would leave a deficiency in the SAC airborne alert and other combat readiness, as well as the research effort looking toward the military mission in space. It would force a cut in some planned procurement in both the ICBM area and the urgent Sky Bolt air-launched ballistic missile program.

It would take about $2 billion more to halt the downward trend of our force levels and provide substantial improvement in USAF's readiness. The B-70 Mach 3 bomber program was put back on the track a few days before election with the release of funds previously frozen by the Bureau of the Budget. Proper consideration of this effort in the new budget could put USAF well on the road toward utilizing the B-70 as a weapon system. Also desirable is more money to press the development of working satellite systems, a long-range interceptor, and the STOL tactical fighter that is listed as a requirement to meet the limited-war threat. Modernization of MATS is another critical item, particularly to meet scattered Communist pressures such as the Congo situation. A maximum effort—the one that would cost over $21.5 billion—also would reach well into the true space age, with more attention to those critical systems.

Some of the critics of our effort in the past two or three years—including such studies as the Rockefeller Report—have recommended that the defense budget be increased by $3 billion and more over the next few years. Some of the Kennedy advisers are known to sympathize with this view but there is no evidence that the new President accepts them or that Congress, which may be more conservative than it has been, will do more than token service to the requirement.

One of the areas in which the Symington advisory group will work, coming up with legislative and executive recommendations for President Kennedy, is that of the budget.

The requirement: How can the White House (1) obtain a defense adequate to protect the nation and to enable it to discharge its international responsibilities, and (2) obtain such a defense within the framework of a free and solvent economic system?

That comes from the charter and the answer is due by the end of this month. There is every evidence that both things are possible if the leadership is adequate and it has a mandate to exercise that leadership.

Another Eye on the Sky

A major step in USAF's inevitable assumption of more responsibilities in the space era came last month with assignment of satellite identification and tracking projects to Gen. Laurence S. Kuter's Continental Air Defense Command at Colorado Springs. One of the projects is SPASUR, a system developed by the Navy for the Advanced Research Projects Agency. The other is USAF's own Spacetrack.

It is entirely reasonable that these missions be put under the aegis of General Kuter, who also heads the US-Canadian North American Air Defense Command. The new system for detection and tracking of ICBMs, the Ballistic Missile Early Warning System, already is feeding information to NORAD. There is no scientist, here or in Russia, who can predict when the threat will originate in space instead of on a launching pad inside the Soviet Union.

Announcing this "realignment," the Defense Department made no reference to the Strategic Air Command and what is necessary for it to carry out its mission as Russian manned bombers are supplemented, first by ground-to-ground and then space-to-ground weapon systems. At this writing there has been no reaction from SAC Headquarters in Nebraska.

When there is a reaction it will be a recognition that ARPA and the Pentagon research monitors now acknowledge space surveillance is a military mission and not just a scientific exploratory effort. SPASUR and Spacetrack, or the systems developed from them, will be part of the free world's deterrent power.—END

The power-packed Hiller E4 brings peak performance and proven reliability to missile site support

Ready and rugged... it's the Hiller E4. It commands 305 hp, which it can handle full time, to full advantage — and at altitude — whether transporting men or machinery. The most powerful U.S. 4-place helicopter in the air today, only the E4 has the safety reserve of power for vertical climb when fully loaded... and at 820 feet per minute!

The E4 is sister ship of a famous line of workhorses, the U.S. Army H-23D Raven, already in missile site support, and the record-setting 12 E, first choice of commercial operators. Both have proved themselves in availability, performance and low maintenance. Following in their path, the E4 has already scored a new record for helicopters with a 2,850 mile flight at 94 mph average true air speed. It's this kind of versatile performance that backs up the E4's wide margin of safety.

For USAF missile site support, the Hiller E4 offers new standards of efficient, dependable transportation for personnel and quickly converts to fly pickup-truck-size loads of high priority cargo. And with it all, the E4 is the lowest cost 4-place helicopter in the air today... both in original price and throughout its life.

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News,
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& Comments

AEROSPACE WORLD

Frederic M. Philips
ASSOCIATE EDITOR

It has been, in greater or lesser measure, a disappointing autumn for Yankee fans, Republicans, and Air Force Academy football rooters.

For the benefit of such persons near and far, here printed in full is Air Force News Service release number 2220 of October 21, a morning-after classic. It followed the Air Force Academy football team's 35-3 defeat at the hands of the Naval Academy squad at Baltimore in mid-October:

70 Years of See-saw
Service Academy Football

"The Naval Academy's defeat of the Air Force Academy Falcons in their first football encounter leaves Air Force fans feeling a little as Navy fans must have felt in 1949 when the Black Knights of West Point beat the Middies, 38-0.

"The Navy turned around the following year to beat Army by a score of 14-2. Again, in 1951, Navy beat Army by a score of 42-7. Last year Navy scored a 43-12 victory over Army.

"Since the first inter-Academy football game in 1890, when Navy beat Army by a score of 24-0, Army has won thirty games, Navy twenty-five, and five games have been ties. Army came back in 1891 for its second game with Navy to win, 32-16.

"Maybe there's a portent of the future here. One battle is not a campaign. Next year and the next will see the Falcons playing Army and Navy in alternating years. The campaign will begin to take shape."

"Whence comes solace?" asked poet Thomas Hardy in similar vein but a different genre some years ago.

". . . In cleaving to the Dream
And in gazing at the Gleam
Whereby gray things golden seem."

So be it, Yanks, Falcons, Elephants. At any rate, with the World Series, the election, and the football season now past, we can all settle back to total involvement with protracted conflict. Anybody know the Las Vegas odds on Khrushchev?

Photo courtesy National Geographic Society

The old and new in Explorers. Left, the Explorer II balloon in which two young Air Corps captains set an altitude mark of more than thirteen and a half miles on November 11, 1935. The anniversary of the flight was marked by an impressive gathering this month. Right, the latest US satellite, the Explorer VIII, a ninety-pound "spinning top" designed to explore the outer ionosphere. It was blasted into orbit by Juno II booster early in November.

☆

Names in the month's news: Sally, Amy, Moe, Valkyrie, Hercules, Explorer.

★ The evolution of man in space continues. Sally, Amy, and Moe, three mice who never had it so nice, contributed to this end on October 13 with a 5,000-mile flight from Cape Canaveral in an Air Force Atlas nose cone. The nose cone, racing at some 17,000 miles an hour, reached an altitude of 650 miles. This was well into the Van Allen radiation belt, which scientists fear may prove a hazard to human safety in spaceflights. None of the three wee beasties had any apparent ill effects from the journey. Their nose cone was taken from the sea by a range vessel three and a half hours after launch.

Sally, Amy, and Moe rode in separate compartments in a sixteen-inch-long, six-inch-diameter sealed cylinder—in effect a miniature man-in-space cabin. The shot signaled the start of a new series of US rocket tests with animals. Plans include orbital flight and recovery of monkeys.

Initials of the animals that took part in the October 13 flight—SAM—stand for USAF's School of Aviation Medicine, Brooks AFB, Tex. The school also provided the monkeys Sam and Miss Sam for shorter rocket flights over the Atlantic some months back.

"This experiment is a step toward finding out how to send human beings into space," Dr. H. C. Clamman of the school told newsmen. "It will help establish guidelines for the type of chamber we need to safely carry man. We are interested in how the mice were affected by confinement in a small area, weightlessness, high gravity forces at acceleration and reentry, noise, and radiation."

The test was, at the same time, less spectacular than the successful Russian recovery of a dog-bearing "flying zoo" from orbit in August.

★ A year ago this month, the Department of Defense announced "reorientation" of the B-70 Valkyrie bomber program. The ambitious program for development of a Mach 3, 80,000-foot-ceiling bomber was cut beyond bare bone for budgetary reasons. The announcement landed like a blockbuster on Air Force planners, who considered the plane vital to national security. On October 31, after almost a year of pressure from Congress, the campaign, and the cold war, the Defense Department acted to put the B-70 back in business.

Specifically, DoD released $155 million of previously frozen funds for development of the Valkyrie, prime contractor for which is North American. Along with the cash came the apparent commitment to develop the B-70 weapon system substantially as it was envisioned before the drastic cut last year. This would include subsystems chopped at that time but judged essential to the B-70's performance as future mainstay of the free world deterrent force.

The champs. Winners of the USAF Worldwide Tactical Fighter Weapons Meet at Nellis AFB, Nev., in September, representing the 4520th Combat Crew Training Wing of Nellis, were Capt. Wallis Calvert, Capt. Aubrey Edinburg, individual top scorer, Col. Ralph Newman, Capt. Robert Bond, and Capt. Harlan Wyman.

Earlier, the Administration had added $35 million to the $75 million budgeted this year for the B-70. Congress last summer voted $184.3 million in additional funds for the plane in a general beef-up of Administration defense expenditures. Until this month, the sum was frozen by DoD. Further money will, of course, be required in the next budget to keep B-70 development going at the now-planned pace.

These plans call for initial test flights by December 1962, with two completed B-70 systems ready for flight testing a year later. Some dozen B-70s are now expected to be built to undergo full testing and evaluation.

★ Twenty-five years ago, on November 11, 1935, two young Air Corps flyers rode a balloon gondola to a higher altitude than man had ever before attained. They were Capt. Orvil A. Anderson, now a retired USAF major general, and the late Capt. Albert W. Stevens. They rose to an altitude of 72,395 feet, more than thirteen and a half miles, under a balloon named Explorer II. Eight hours and thirteen minutes after launch from the giant, cup-shaped Stratobowl near Rapid City, S. D., the balloon came to earth near White City, S. D., 230 miles away. Captains Anderson and Stevens, who brought back valuable high-altitude data, were above 70,000 feet for an hour and forty minutes. This achievement was not equaled until the post-World War II exploits of high-altitude explorers including USAF's Lt. Col. David G. Simons and Capt. Joseph W. Kittinger, Jr. The latter reached 102,800 feet under a balloon in August to set the present record.

Cosponsor of the Explorer II flight with the Air Corps was the National Geographic Society. On Veterans' Day this year, the silver anniversary of the ascension, top USAF officers and society officials gathered at the launch site in the shadow of South Dakota's Mount Rushmore to commemorate the occasion. Gen. Curtis E. LeMay, USAF Vice Chief of Staff, SAC Lt. Gen. John P. McConnell, Colonel Simons, and Captain Kittinger were among those on hand to honor General Anderson.

(Continued on page 29)

New photo of Armed Forces Policy Council: AF Chief of Staff Gen. Thomas D. White and Secretary Dudley Sharp, Army CoS Gen. George H. Decker, Secretary Wilber Brucker, DoD Deputy Secretary James H. Douglas, Secretary Thomas Gates, Navy Secretary William Franke, CNO Adm. Arleigh Burke, JCS Chairman Gen. Lyman L. Lemnitzer, Marine Corps Commandant Gen. David Shoup, and John Rubel, Deputy Director of Defense Research and Engineering. Picture taken Oct. 4.

Magnavox continues to maintain a position of leadership in the airborne communications field.

Magnavox engineering, in conjunction with the Air Force, has developed an advanced airborne communication system that is designed to meet the requirements of the future. Utilizing wide band techniques, such functions as television relay for bomb damage assessment, data link for control and identification, and many other forms of air-to-air and air-to-ground communications can all be realized over the same equipment as used for voice.

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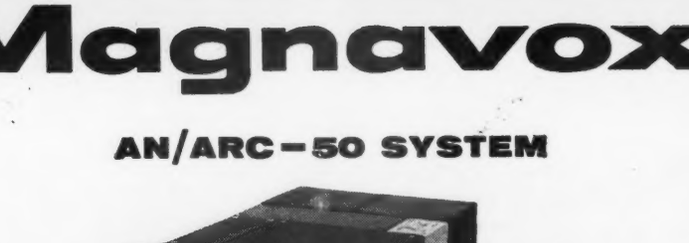
AN/ARC-50 SYSTEM



COMMUNICATIONS	RADAR	DATA HANDLING	ASW	MISSILES

THE MAGNAVOX CO. • DEPT. 309 • *Government and Industrial Division* • FORT WAYNE, IND.

Sharing the spotlight with General Anderson was retired USAF Lt. Gen. William E. Kepner, who took part in an earlier Explorer I balloon flight with Captains Anderson and Stevens. Explorer I, after ascending from the same site in July 1934, tore open at 60,613 feet, floated down at an accelerating rate of speed, and exploded when it hit the ground. The three airmen parachuted to safety from about 2,500 feet.

★ Into orbit on November 13 went a ninety-pound "spinning top" satellite designed to perform an extensive study of the earth's ionosphere. A four-stage Juno II booster blasted off NASA's thirty-inch-diameter Explorer VIII. It was America's twenty-sixth successfully orbited artificial satellite compared to Russia's six. This was the first of several satellites planned to probe the outer ionosphere, which extends from fifty to about a thousand miles up. The ionosphere contains several layers of electronically charged particles that reflect radio waves back to earth. The hope was that studies of the region would help improve ground-to-ground, ground-to-air, and eventually ground-to-space communications. The lower ionosphere had already been probed to a considerable extent by sounding rockets.

Explorer VIII was shaped like a giant version of a child's toy top and, in addition, spun during flight for stabilization. Radio transmitter of the new satellite was expected to operate for two or three months. The current Explorer test shot series began in January 1958.

★ Yet again, a Lockheed C-130 Hercules transport of USAF's 6511th Test Group (Parachute) set a heavy-equipment drop record. This time, on October 12, a Group C-130 parachuted a cargo of scrap metal weighing 41,740 pounds to the floor of the desert at the El Centro, Calif., Naval Air Station. The 6511th began a series of test drops early this year in an ARDC project. At that time, a British Royal Air Force plane had performed the heaviest equipment drop on record —31,000 pounds. On May 12, one of the USAF C-130s dropped 35,000 pounds. On July 20, 40,500 pounds of equipment, more than twenty tons, plummeted from a Hercules onto the sun-drenched sand.

★ The Minuteman ICBM was the headliner of the missile month. USAF announced on November 5 that operational date for the first Minuteman squadron had been advanced a full year to July 1962, with fifty-five missiles in underground silos in the vicinity of Malmstrom AFB, Mont. In other missile news, Titan achieved its longest test shot, 6,100 miles, 100 miles longer than any previous shot, on October 24. An Atlas went 7,000 miles a day later. And on October 14 USAF announced that it had accepted the Bomarc-B air defense missile, which experienced tough sledding in tests some while back, for quantity production. The A model has been operational since late 1959.

☆

In the frenetic defense industry swirl of shifting technologies and shifting weapon system requirements, one problem has grown steadily with the years. It is the problem of finding trained, adequately experienced engineers and scientists to meet the demands of programs under way at any given time. Page after page of large display advertisements directed at such persons appear each week in major publications. Industry recruiters make regular visits to campuses throughout the nation, with concerns devoting increasing attention and increasing funds to the matter of getting the right personnel. Starting salaries go up, up, up. Still the problem remains.

The long-term answer is education, of course. The nation's schools must,

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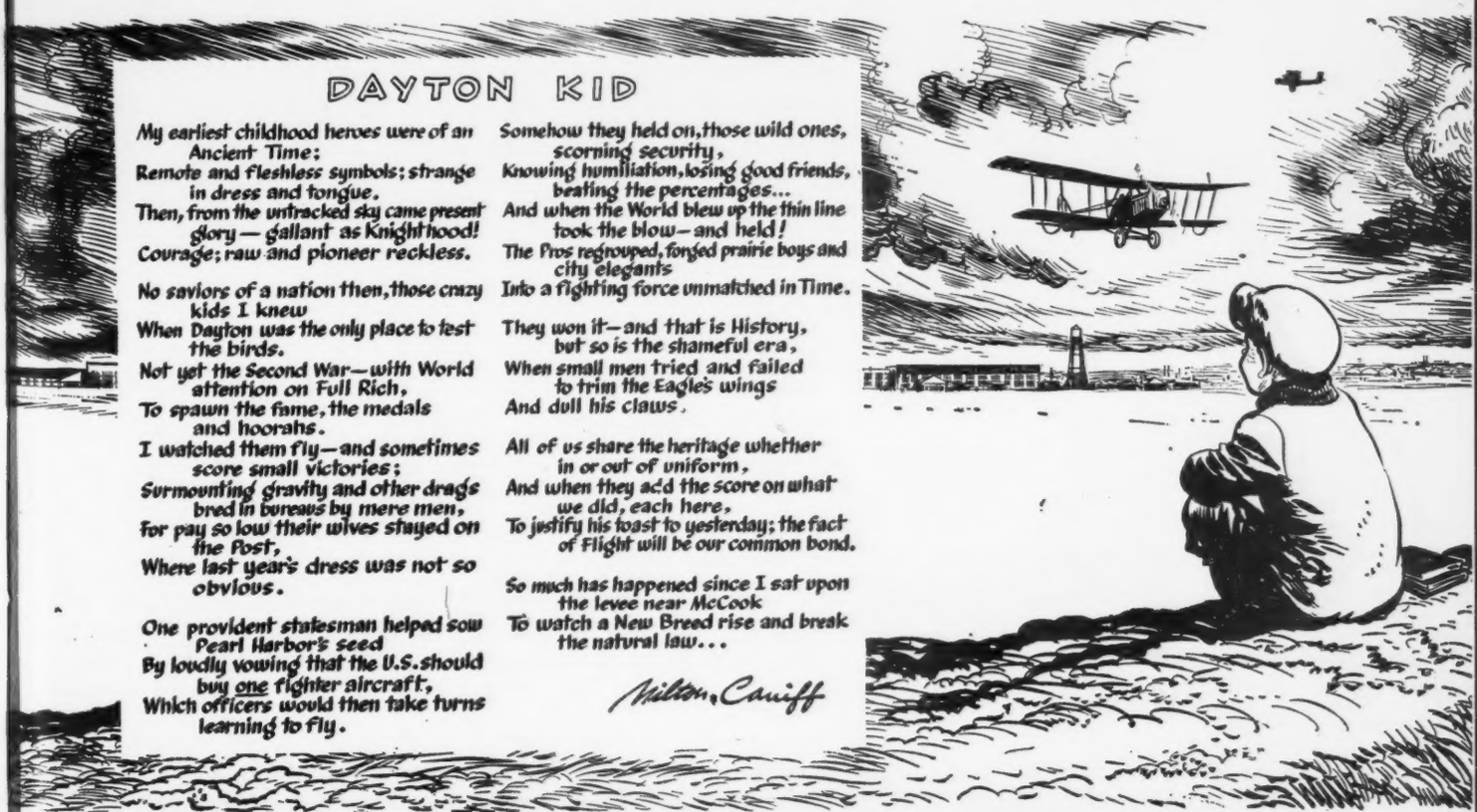

DAYTON KID
My earliest childhood heroes were of an Ancient Time;
Remote and fleshless symbols; strange in dress and tongue.
Then, from the untracked sky came present glory — gallant as Knighthood!
Courage; raw and pioneer reckless.
No saviors of a nation then, those crazy kids I knew
When Dayton was the only place to test the birds.
Not yet the Second War—with World attention on Full Rich,
To spawn the fame, the medals and hoorahs.
I watched them fly—and sometimes score small victories;
Surmounting gravity and other drags bred in bureaus by mere men,
For pay so low their wives stayed on the Post,
Where last year's dress was not so obvious.
One provident statesman helped sow Pearl Harbor's seed
By loudly vowing that the U.S. should buy one fighter aircraft,
Which officers would then take turns learning to fly.
Somehow they held on, those wild ones, scorning security,
Knowing humiliation, losing good friends, beating the percentages...
And when the World blew up the thin line took the blow—and held!
The Pros regrouped, forged prairie boys and city elegants
Into a fighting force unmatched in Time.
They won it—and that is History, but so is the shameful era,
When small men tried and failed to trim the Eagle's wings
And dull his claws.
All of us share the heritage whether in or out of uniform,
And when they add the score on what we did, each here,
To justify his toast to yesterday; the fact of Flight will be our common bond.
So much has happened since I sat upon the levee near McCook
To watch a New Breed rise and break the natural law...
Milton Caniff

Long-time AFAer Milton Caniff's "Dayton Kid," above, will appear in newspapers throughout the country at Christmas. An enlargement is scheduled to join work of other aviation cartoonists at National Aviation Club in Washington, D. C.

The bagpipers of the US Air Force Band on the march at Bolling AFB, D. C., in new ceremonial uniform of the Mitchell tartan. It was selected in honor of Gen. Billy Mitchell. The unit has been in existence for ten years, but until now members have worn regular USAF uniforms.

Air Force Secretary Dudley Sharp accepts gift falcon from representative of Saudi Arabian King Ibn Saud in ceremony at Dhahran Air Base in the Arab nation during recent visit. Others present include, left, USAF Brig. Gen. James C. McGehee, mission chief, and Saudi officer.

plainly, turn out an increasing number of scientists and engineers to meet the needs of today and tomorrow. Over the shorter haul, the task is to get trained persons into the jobs where they are required. Many aspects of US education have been spotlighted in recent years, at least since Russia gave us second thoughts about ourselves by launching Sputnik I three years ago. Now a fresh approach to the day-to-day business of bringing prospective technical employees into touch with concerns looking for new blood is being provided by an eager-beaver New York personnel firm, Careers, Inc.

Early this month, for example, Careers will run what it calls a Career Center for scientific and engineering personnel in Washington, D. C. Each employer taking part in the center, scheduled from December 5 through 8 at a Washington hotel, will operate an interviewing booth. Prospective employees will register at a central Careers desk. They will fill out forms showing qualifications and experience, which will then be duplicated and sent around to each concern booth. The blanks will be identified by numbers, with no names, to keep the applications on an anonymous footing—and prevent possible embarrassment to job seekers. When a concern interviewer finds an application that intrigues him, he will shoot a request to the Careers desk to see applicant number umpty-ump. The applicant, when he hears his number called, may be on the way to a new job—or he may after his interview return to the floor of the center and await further conversations with other concern representatives.

The object of all this is to bring "buyer" and "seller" in the job market together under conditions that Careers feels to be extremely efficient. The personnel outfit offers figures to show that their way cuts recruitment outlays sharply. The applicants pay nothing. And afterward, the applications remain on file for further reference by the concerns involved. Many top companies seem to agree. Twenty-four firms, most of them important defense contractors, took part in an August Career Center in Los Angeles. The center drew some 5,000 visitors, 1,500 of whom registered for job interviews.

An estimated twenty outfits will be interviewing at the Washington center, among them the National Aeronautics and Space Administration. NASA also took part at Los Angeles, as did the Federal Aviation Agency and the Army Ordnance Missile Command. ARDC, AMC, and Hq. USAF have, in addition, advertised in Careers, Inc., publications for scientists and engineers.

☆

Candied parsnips, anyone? How about some baked cabbage and cheese?

If you turn up (sometimes called rutabaga) your nose at these culinary suggestions, your views on this score are pretty much in keeping with those of most of our folks in uniform. A recently released study of food preferences of US servicemen listed these foods as least liked: mashed turnips, broccoli, baked hubbard squash, fried parsnips, creamed asparagus, cabbage baked with cheese, asparagus with hollandaise sauce, iced coffee, cauliflower with cheese sauce, and candied parsnips.

The favorites, which might conceivably have been guessed, were listed in this order: fresh milk, hot rolls, hot biscuits, strawberry shortcake, grilled steak, ice cream, ice cream sundaes, fried chicken, french fried potatoes, and roast turkey.

The study, done for the Army, produced a detailed 160-page report for the benefit of those who handled armed forces feeding. These were some of its further findings. Vegetables as a class, with the notable exceptions of corn on the cob and sliced tomatoes, are the "least liked of all foods." Soups and salads were just a cut over vegetables in this regard. Meat-fowl-fish category dishes and deserts were most liked, although a number of items here including baked fish, omelets, bread pudding, and rice pudding were found to bring forth minimal enthusiasm from chow lines around the world.

☆

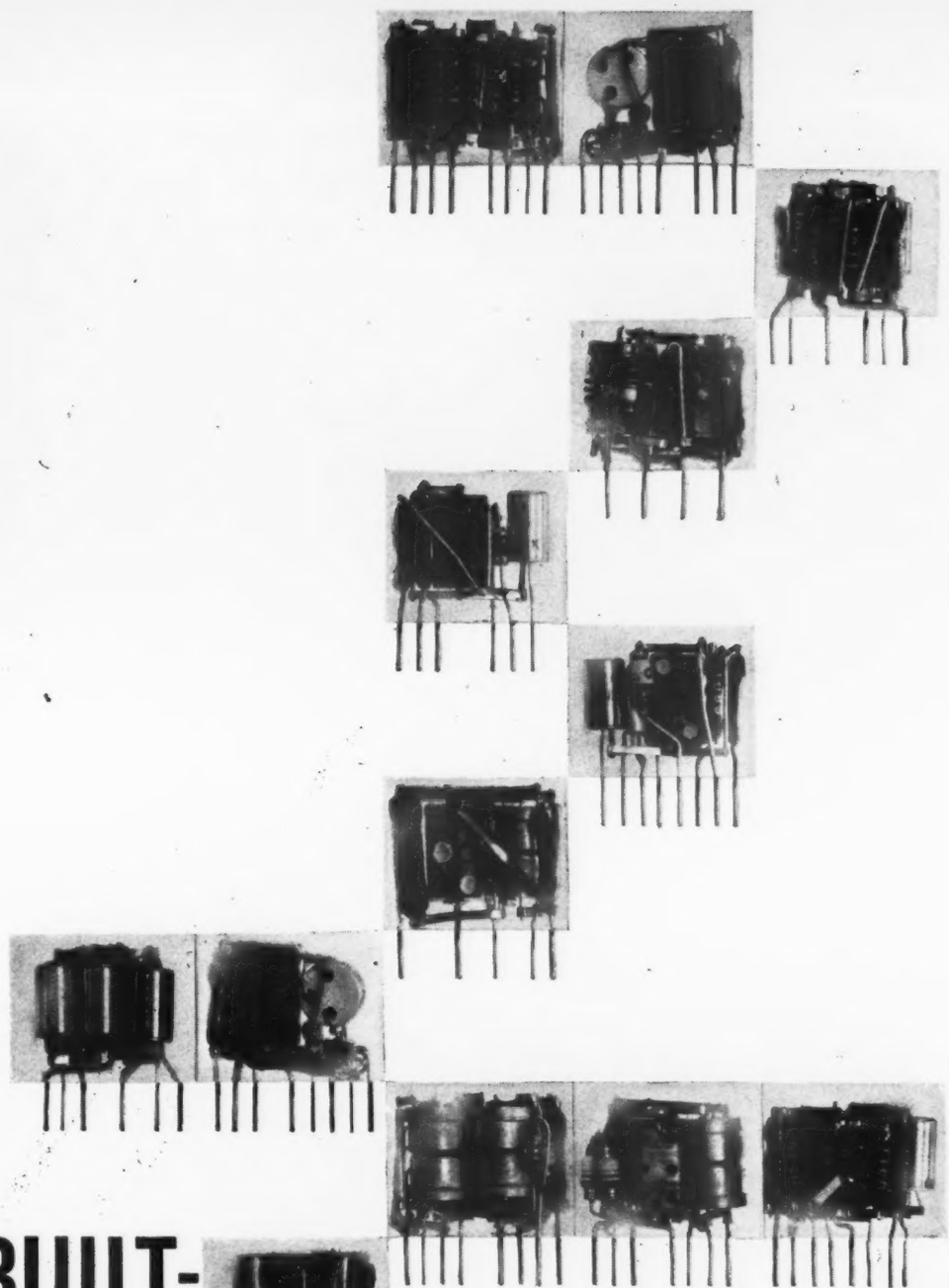
ELSEWHERE IN THE AEROSPACE WORLD:

In a move paralleling the rereorientation of the B-70 program, USAF announced at the beginning of November that it plans to close the B-58 program with production of 116 of the aircraft, first models of which have been turned over to SAC.

USAF failed in an effort to launch a Discoverer XVI satellite, another in the series of developmental space shots, on October 26.

On October 27, two more Russian spies were arrested in New York on

(Continued on page 32)



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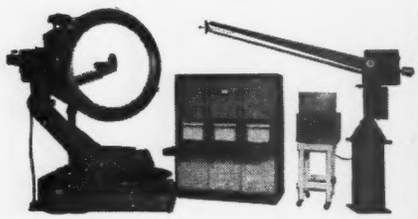

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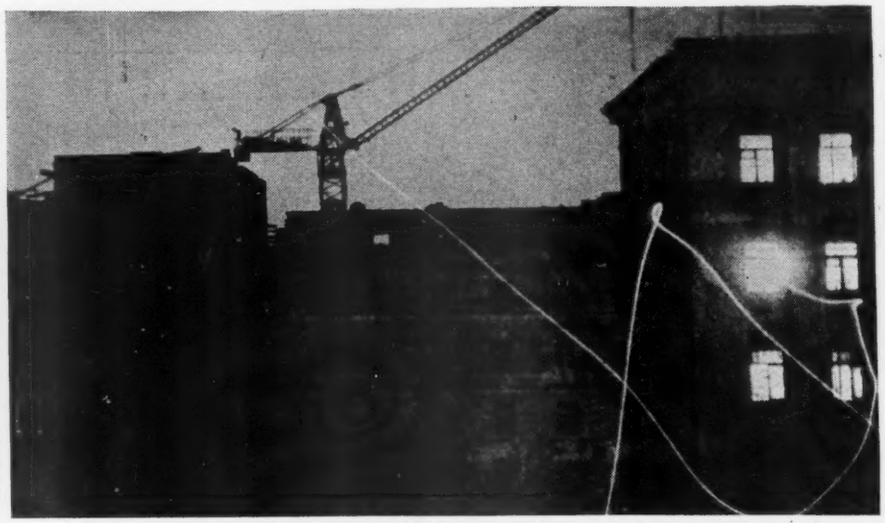
AEROSPACE WORLD — CONTINUED



This is *Kugelblitz*, or ball lightning, in a rare photograph by a Russian. In its zigzag course, ball lightning outlines a path similar to that of tracer bullets. USAF's Cambridge Laboratories at Hanscom Field, Mass., are involved in a study of the subject. Scientists there hope for reports of sightings.

charges of attempting to obtain aerial photographs and military maps of Chicago for use in Russian targeting.

With announcement in late October that the Washington Senators baseball team was transferring its franchise to Minneapolis, it was revealed that the Federal Aviation Agency Administrator, retired USAF Lt. Gen. Elwood R. Quesada, was one of the prime aspirants to obtain a new Washington American League franchise.

Ground-breaking ceremonies marked the start of construction of a 40,000-seat football stadium at the Air Force Academy on October 27.

More than 17,000 Air Force civilian employees received cash bonuses for outstanding work during fiscal year 1960, it was revealed in November.

General White, USAF's Chief of Staff, has approved display of some fifty-nine battle streamers with the official Air Force blue-and-yellow flag. The streamers represent battles and campaigns since military aircraft came into use in World War I.

The Coast Guard has announced a nonstop distance record for a plane of that service, a Lockheed SC-130B flight from Shemya Island in the Bering Sea to Elizabeth City, N. C., 5,225 miles, in fourteen hours and six minutes.

The USAF Institute of Technology at Wright-Patterson AFB, Ohio, has been graduating seventeen percent of the annual national output of nuclear engineers, fifteen percent of aeronautical engineers, and about fifty percent in the areas of astronautics, guidance, and control, it was reported in Washington.

A total of 70,747 airplanes were in the active civilian aircraft field, commercial and otherwise, at the end of 1960, FAA disclosed. This represented a slight increase over the 1958 total. Airlines accounted for 2,020 planes.

A TAC C-97 specially outfitted with communications equipment in November began five months of global test flights to develop an airborne command post and communications center for TAC and MATS operations. Still in the planning stage, such an aircraft would be a counterpart of the two SAC KC-135 airborne command posts. The TAC-MATS concept would call for a plane, or mobile equipment designed for any plane, able to meet both airborne and ground communications requirements when units of either of these commands rushed to a world trouble spot. The test project was labeled "Talking Bird."

USAF Capt. Robert A. Rushworth became the sixth man to fly the X-15 at Edwards AFB, Calif., on November 4. A week earlier, NASA test pilot John McKay became X-15 pilot number five.

☆

STAFF CHANGES. . . . Brig. Gen. Joseph E. Gill, from Deputy Commander for Site Activations, AFBMC, AMC, Inglewood, Calif., to Director of Site Activations, AFBMC, AMC, Norton AFB, Calif. . . . **Brig. Gen. William E. Leonhard,** from Deputy Commander for Facilities, to Deputy Commander for Civil Engineering, AFBMD, ARDC, Inglewood, Calif., retaining additional duty as Assistant to the Commander for Site Activations, AFBMD, ARDC.—END

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Illustrated is a laboratory model of a thermally regenerative liquid metal fuel cell for the conversion of heat to electricity, jointly developed by Allison and Delco-Remy Divisions.

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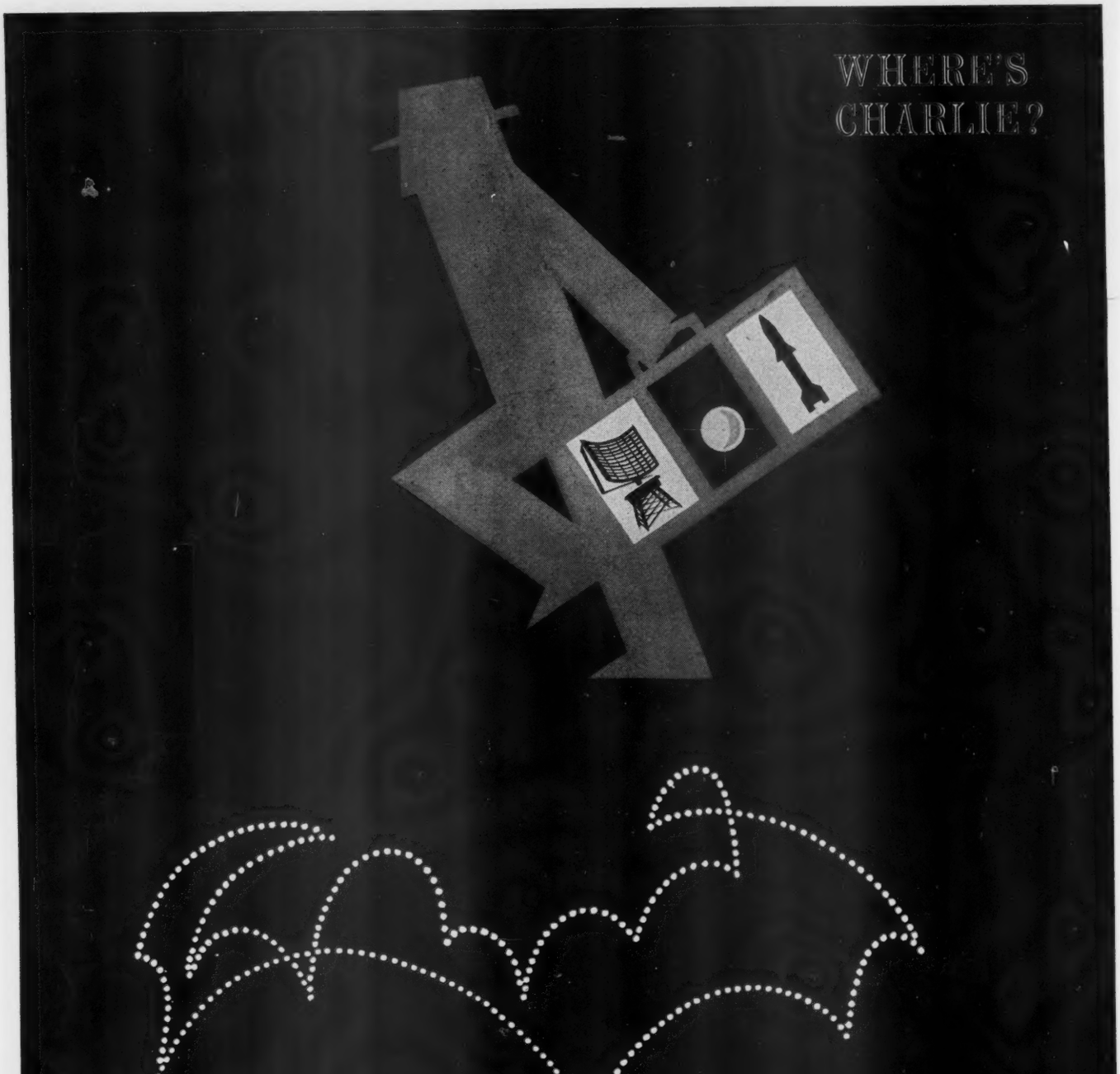

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AIR FORCE
DECEMBER 1960

Power, prestige, and peace were the major issues of the presidential campaign just concluded. Recognition of the interplay of these factors must remain central to our national policy. Specifically, one of our foremost immediate aims must be progress in . . .

SPACE: LABORATORY AND BATTLEFIELD

John F. Loosbrock
EDITOR, AIR FORCE/SPACE DIGEST

POWER. PRESTIGE. PEACE.

These were the major issues of the presidential campaign just concluded—whether indeed the United States was slipping badly in the first two areas and thereby endangering the prospect of the last.

The American people, by the slenderest of margins, have chosen to believe that our national power, and therefore our national prestige, need shoring up in significant areas as a necessary prelude to the achievement of a just and honorable peace. It is in this context that the following observations are offered.

First of all, it is necessary to recognize that national power and national prestige cannot be discussed in a vacuum. They are relative terms, meaningful only when measured against the power or the prestige of someone else. We have to be stronger than our opponents, not merely stronger than we were yesterday. Our prestige has to be higher than the other fellow's, not merely higher than it's ever been before. Further, we must face up to the fact that it is not solely a question of our own judgment in these matters. Our power and prestige are under constant assessment by our prospective opponents, our allies, and by the millions of uncommitted third parties of the world. And, to a large degree, the actions of all these are governed by what they see when they look at the United States.

Nowhere is the interplay among the factors of power, prestige, and peace more dramatically illustrated than in the vast arena of space. It is here that Soviet Russia's bold exploitation of her technological progress has captured the imagination of the undeveloped nations. This is not to say that US space achievements have been inconsiderable. But we have thus far failed to take full advantage of our broad scientific, technological, and military potential and the contributions that each can make, in the space arena, to the power and prestige factors of the international equation. Our national space effort has been splintered and disoriented, so that the effort has never been equal to the need nor the results proportionate to the effort.

(Continued on following page)

SPACE: LABORATORY AND BATTLEFIELD — CONTINUED

The compartmentalization that has characterized our efforts in space to date has been basically of two varieties—one horizontal, one vertical. Horizontally, there has been a denial of the fact that air and space, in a military sense at least, represent an operating continuum. There has been a failure to recognize that there is no sharp cleavage between the two and that the operational concepts that apply to the one can be efficiently and logically extended into the other. It has been almost as if the Navy were to be limited as to the depth to which its submarines might submerge or the Army as to the height of hills it might climb in seeking a commanding position. The horizontal compartmentalization has stemmed unquestionably from the reluctance of the current Administration to assign the operational space mission to the government agency most obviously qualified to undertake it —the United States Air Force—with research support from a NASA unfettered by operational and policy responsibilities. A strange reluctance, we might add, in view of the fact that the Air Force currently possesses ninety percent of the space capability of the nation.

Indeed, there has been an even more deep-seated reluctance to admit that there is a military mission in space of any kind. It is this which has led to the vertical dichotomy mentioned above—the artificial boxing off of space into two neat compartments, one labeled "peaceful," the other labeled "military"—and to go about our business as if there were no relationship between the two or, even worse, as if there were conflict.

What has been forgotten is the fact that technology recognizes no labels. It is neither peaceful nor warlike, per se. It is nonpolitical and will serve any master who has vision enough to bend it to his will. Technological progress knows no boundaries. It has no loyalties, either to a uniform or to a flag. It is good or evil only as are the ends toward which it is directed.

Fortunately, technology has a habit of solving the problems which it creates. And there are developments on the horizon which not only offer new solutions to old problems but which give rise to new concepts which may eliminate most of the organizational, technical, and operational conflicts now plaguing us.

Speaking in Los Angeles in October to the Society of Automotive Engineers, Lt. Gen. Roscoe C. Wilson, AF Deputy Chief of Staff, Development, told of a winged, manned vehicle which would be *flown*, rather than *shot* into orbit, and which would be returned to earth in a controlled manner. According to General Wilson, "Such a vehicle would be able to take off and land conventionally and combine many of the advantages of a rocket booster and an aircraft. From our investigation, this concept of a future aerospace

MILITARY STRATEGY'S FOURTH DIMENSION

Space has vast military potential. The fact is obvious, although technical progress has yet to fill in the details of this potentiality. And, looking ahead, the nation that controls space may well control the planet earth on which we live. The quotations below, gleaned from the pages of back issues of AIR FORCE/SPACE DIGEST, *and the article that begins on the preceding page explore this new spatial dimension of the military strategy equation.*

APRIL 1957: "In the long haul our safety as a nation may depend on our achieving 'space superiority.' Several decades from now the important battles may not be sea battles or air battles, but space battles, and we should be spending a certain fraction or our national resources to ensure that we do not lag in obtaining space supremacy."—LT. GEN. BERNARD A. SCHRIEVER

MARCH 1958: "It is a far cry from a piece of hardware to an operational capability, a long step from a chunk of unmanned metal circling earth to an operational capability in manned spacecraft. And only in the Air Force does the nation possess an organizational . . . base on which such a capability can be built." —THE EDITORS, AIR FORCE/SPACE DIGEST

APRIL 1958: "Only through our military capability to control space will we be able to use space for peaceful purposes. I visualize the control of space as the late twentieth-century parallel to the age-old need to control the seas and the mid-twentieth-century need to control the air."—GEN. THOMAS D. WHITE

APRIL 1958: "The use of outer space . . . adds additional cubic footage, enormous quantities thereof, to the potential locations of our strategic force. It adds new problems for an enemy seeking to know its location and planning to obliterate it."—DR. SIMON RAMO

NOVEMBER 1958: "Herein, I believe, lies the real significance of strategic space operations of the future—the compression of time for both action and reaction to the point where the dramatic role of the time factor will, in effect, assume the significance of a new dimension in military strategy."—GEN. THOMAS S. POWER

JANUARY 1959: "There has been great concern throughout the free world that space will not be used strictly for peaceful purposes. There has been no such concern evident in the Communist camp. Why? Let's face up to the answer. The Communist leaders know beyond a shadow of a doubt that the free world longs with all of its collective heart to keep free space free. They rely on this longing. They abet it with hollow pronouncements while pursuing secure programs under strict military discipline."—REAR ADM. JOHN E. CLARK, USN, THEN DEPUTY DIRECTOR, ARPA

JANUARY 1960: "A scientist explores beyond the boundaries of past experience to enlarge his fund of knowledge. It is a powerful attraction—but not a matter of life or death. But the airman, soldier, or sailor moves forward into the unknown for the salvation of his country—for the safety of his own and his neighbor's family, and their freedom to live as they choose. He investigates new regions—on the earth or in space—because he must exploit them, if he can, before a potential enemy seizes them for a military advantage. This is a built-in incentive for progress of the highest order which is peculiar to the military."—LT. GEN. BERNARD A. SCHRIEVER

APRIL 1960: "It is specious reasoning to pretend that we can profitably separate 'peaceful' space from 'military' space. Like the earth on which we walk, the sea over which we sail, and the atmosphere through which we fly, space holds great advantage for both military and civilian use, and it is dangerous and misleading to try to split the two."—JOHN F. LOOSBROCK, EDITOR, AIR FORCE/SPACE DIGEST

SEPTEMBER 1960: "Our experience with the Soviets indicates that they will not hesitate to use space as a military arena if it seems advantageous; hence it is essential for us to keep pace with their capability, even though we have no real idea as to their intentions. . . . In a real world, unpleasant as it often is to all of us, space technology potential must be exploited for defensive military reasons." —WILLIAM LEAVITT, ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

vehicle appears feasible, but a research and development effort over a considerable number of years is necessary to bring this craft to reality."

As usual, the first trade magazine reports amplifying General Wilson's remarks centered on the technical details of the Space-Plane concept, pinning it to a feasibility study on one ingenious propulsion system. In this approach, to give the bare details, the Space Plane, using chemical or, better yet, nuclear power and, utilizing aerodynamic lift from its wings, would fly to the upper limits of the atmosphere, where it would manufacture its own liquid oxygen, drawn literally out of thin air, until it had stored enough to proceed on whatever its spaceborne mission might be.

The Air Research and Development Command is deeply interested in this approach to spaceflight. And behind the scenes enthusiasm abounds—enthusiasm backed up with solid scientific endorsement for the concept, although the propulsion system outlined above appears to be only one of several promising approaches.

Should this enthusiasm be justified, and there is every reason to think that it will be, much food for thought is provided the new Administration in terms of how it approaches the contributions that space can make to the triple national objective of power, prestige, and peace.

Let us examine, for a moment, the historical perspective against which the Space-Plane concept must be assessed.

From before the dawn of recorded history man has thrown objects through the air—stones, spears, arrows, cannonballs, bullets. Man's conquest of the air, however, dates only from December 17, 1903, when the Wrights first flew at Kitty Hawk. The air was not considered conquered, then, until man himself ventured into it, in vehicles of his own design and construction, when he could take off from where he chose and return to where he chose, in purposeful maneuvered flight.

If one accepts this analogy in terms of spaceflight, then with all our wonderful accomplishments we are not yet at the Kitty Hawk of space. Not even today, though we have been throwing missiles into space and back again for years; not even though we are able to shoot satellites into predetermined orbits and retrieve capsules from them. Nor will we yet be when the first Astronaut is successfully placed in orbit in the womblike Mercury capsule. Until the Space-Plane concept appeared we were still, as Dr. Hugh Dryden of NASA once described an early man-in-space proposal, shooting a man out of a cannon.

The Air Force has always been uneasy about this "Barnum-and-Bailey" approach to manned spaceflight and has doggedly pursued its programs with the X-15 and Dyna-Soar as the more realistic and desirable alternative. Space Plane is the logical follow-on in this philosophy.

The Space-Plane concept also has implications in the budgetary field. The pressures of technology are forcing military weapon systems into a cost spiral, with one costly system piled atop another, that makes even the most fiscally liberal proponent wince. The idea of a multipurpose military vehicle, first discussed cautiously by General White at the Air Force Association Convention in Miami Beach in 1959, is an attractive one. Grouping of several capabilities into a single system will be a definite requirement very soon, if it is not already.

Likewise, maneuverable aerospace flight, as exemplified in the Space-Plane concept, adds an entire new dimension to mobility and dispersal of forces, and thereby to the invulnerability of those forces and the effectiveness of the deterrent. At the moment we are planning to place Minutemen on sixty-mile-an-hour railroad trains and we are about to place Polarises in thirty-mile-an-hour submarines. We call this "mobility." These are necessary transition steps to be sure, but in terms of speed for a weapon platform they represent a far comedown even from the B-17s and B-29s of World War II. Railroad cars, submarines, holes in the ground, even airborne missiles must be recognized for what they are—not ultimate answers but transitory stopgaps.

In terms of power and prestige once again, one does not show the flag from beneath the Arctic icecap or from a railroad flatcar somewhere in Wyoming. These expedients hold the fort for freedom while technology moves on. We must move with it and history shows that really fast movement comes only when one "slips the surly bonds of earth."

There are new frontiers aplenty in the years that lie ahead, far more than we can perceive even dimly at the moment. Whether or not the Space Plane, as presently conceived, is a practical vehicle is relatively unimportant. What is important is to recognize that the kind of spaceflight it represents will surely come and it will be a tremendous blow to national prestige if we once again come in second—as we did in the case of Sputnik I, as we surely will do with the first man into orbit. But, and even more important, the power implications precede and transcend those of pure prestige. In fact, the Soviets have already warned that the Soviet Union "will be able to protect its security against any encroachment from outer space just as successfully as it has done with respect to airspace."

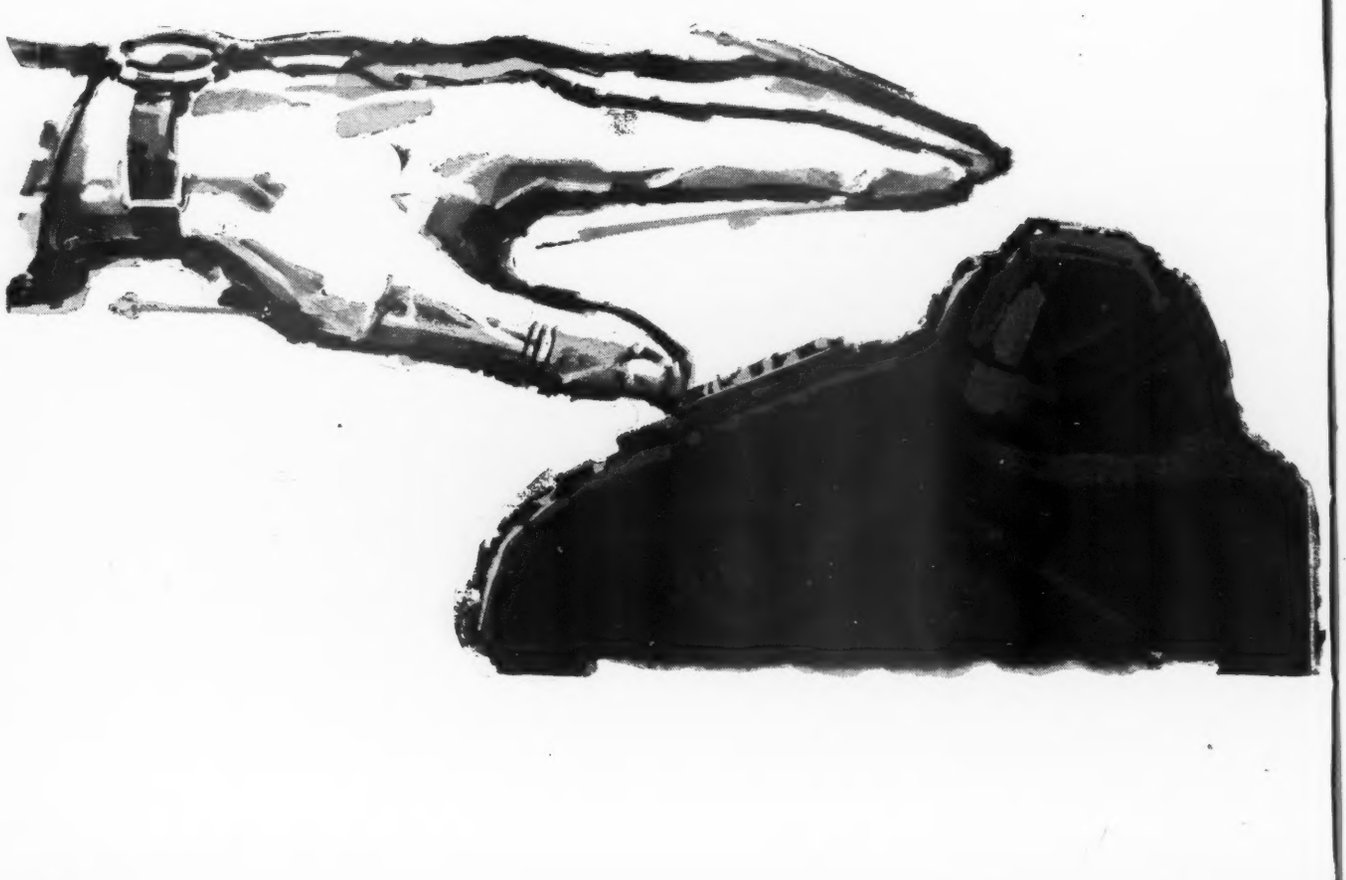
We approach the future under a new Administration, free to discard without prejudice the halters and blinders of its predecessor in this vital area. The path seems clear.

- We must recognize the validity of the military mission in space as part of our deterrent posture.
- We must place the responsibility for that mission where the logic of experience, doctrine, and capability dictates, in the United States Air Force.
- We must recognize that the peaceful and purely scientific aspects of space exploration, while necessary and highly desirable, do not possess the urgency of the military space mission and moreover can be more quickly obtained as fallout from a high-priority military program than in any other way.
- We must broaden our vision and unleash our minds so that we can leapfrog the Soviets technologically and force them to explain to the world, for a change, why *they* are second best.
- We must employ our space program as a tool to gain *both* power and prestige with the ultimate goal of a just, honorable, and lasting peace.—END

(For further comment on the military space mission, see SPACE DIGEST, page 67.—THE EDITORS.)

To meet our all-around deterrent requirements, writes the author, we need "strategic forces that do not have to go off like a match in a fireworks factory when the lights start flashing." We need a broad range of deterrent capabilities. We must be able to respond with care, control, and sensitivity. Perhaps most important of all, we must have a force that can survive. With such a force, we can meet the demands of cold war and, if need be, all levels of hot war. Further, we are in a favorable position to combat the very real dangers of "accidental," "preemptive," "false alarm," or mischief-inspired aggressor attack. Such deterrent forces would provide optimum survival insurance in a world haunted by visions of . . .

METEORS, MISCHIEF, AND WAR



Thomas C. Schelling

Dr. Schelling is a professor of economics at the Center for International Affairs, Harvard University. He has been a RAND Corporation senior staff member, a government economist, and an editor of the American Economic Review. *He is currently on the editorial board of the* Journal of Conflict Resolution. *Dr. Schelling is the author of three books, including* The Strategy of Conflict.

The following article is reprinted with permission from the September 1960 issue of the *Bulletin of the Atomic Scientists*.

IF WAR is too important to leave to the generals, accidental war should not be left to novelists. But for the time being they have it; and while few of them have given a full scenario of how war might come about, they have at least been more explicit in public print than the analysts.

We have had a number of hints, including some vivid ones from Khrushchev and his colleagues, that seagulls or meteors may look like aircraft or missiles on a radarscope, and that personnel screening in an air force (theirs or ours) may not absolutely eliminate the mischievous psychotic. We have had predictions that petty dictators may soon have the ability to startle us out of our wits with a nuclear explosion somewhere. We have had evidence in the newspapers that a nuclear weapon may drop out of an airplane in peacetime, though not that one can detonate under the circumstances. But while it is easy to imagine how accidents might occur, it is not so easy to trace out how they might lead to war.

Literary Flashback

In addition to whimsey inspired by the meteorites that left craters in Arizona and Siberia, we have had several fictional efforts to get a war plausibly started. Nevil Shute's *On the Beach* has an advantage: We are already in the aftermath before the origin of the war is revealed. The war being taken for granted, its origin can afford to be sketchy and ironic. Still, the sequence of events may illustrate what people have in mind. Apparently the Russians and the Chinese were spoiling for a war, but the initiative came from the Albanians who dropped a bomb on Naples; next was a bomb on Tel Aviv, origin unknown. The Americans and British made gestures at Cairo, which responded with bombs on Washington, which led the Americans to retaliate on Russia. "Somebody had to make a decision, of course, and make it in a matter of minutes. Up at Canberra they think now that he made it wrong."

China took the occasion to finish off Russia, and both went after each other with radiological weapons. An ironic touch in this sketchy flashback is that the Americans apparently never played a leading role, once hostilities got really started. (The war occurred, incidentally, just about a year from now.) By the time the war was badly out of hand, whoever was making decisions lacked the organization to stop it.

This may be too easy: false alarms, misunderstandings, *n*th-country problems, and two of the large countries premeditating war anyhow. With all these ingredients—and a little accelerated technology and dramatic license—the reader may assume a horrendous casserole no matter how they are mixed. But even if it is a caricature, the picture of human error and impotence probably epitomizes the popular notion of "accidental war" and the widespread sensation that the machines are taking over.

Alas, Babylon, by Pat Frank, also gets its war started in the Middle East, but the mixture is a little different. In this one deterrence fails because, though we can lick the Russians and we know it, they don't. We also, in this one, have the advantage of "strategic warning"; we know that the Russians are willing to press the issue in the Middle East to the point of general war, but apparently cannot use our forewarning either to attack them first or to persuade them that, their secret having leaked, their chances of success are small. Some interesting dynamics are included: Though the Russian decision is prompted by a Middle East crisis, it is affected by their belief that their forces, though superior, are only temporarily superior and that the opportunity will be gone if they wait until we catch up. Finally, there is at least one inflammatory "accident," an air-to-air rocket that misses its target and falls on Latakia with vivid results. This novel, too, is mainly about the aftermath of war; it is an imaginative study of civil defense and organization, but getting the war started is incidental. The causation is impressionistic; and the role of "accidents" is only hinted at.

The Brink of War

For a detailed scenario of how war might start, or almost start, we have to turn to the paperbacks. One

(Continued on following page)

of the niftiest little analyses to come along is *Red Alert,* by Peter Bryant, which explores the possibility that a really sophisticated SAC general, properly placed, with a few lucky breaks, might get the United States committed to an all-out war with Russia, a war that he believes inevitable but only on highly unfavorable terms unless he can force his country to take the initiative. The sheer ingenuity of the scheme, beautifully analyzed in "realistic" detail, with emphasis on the system rather than on personalities, exceeds in thoughtfulness any nonfiction available on how war might start. The value of the narrative does not lie in the possibility that SAC is so organized that the story could be true; one can suppose that the crucial details have been invented for the sake of the story. What is impressive is how plausible a story can be invented. The author does not frighten us with how loosely SAC might be organized and how easily the system could be subverted; what makes this book good fiction is what makes a good mystery—the author has used his ingenuity to make the problem hard.

The climax, though, is what deserves pondering. The last-minute bargaining by the Russian and American governments, though less plausible than the rest of the book in its details, is a unique examination of the brink of war. As a contribution to the literature on war and peace, *Red Alert* not only demonstrates the occasional superiority of dramatic over logical discourse, but by its example indicts a public discussion that has not got beyond "Prewar Strategy" to Chapter 2, "The Brink of War." If an accident, or a bit of mischief, or a false alarm, or a misunderstanding, can lead to war *but not necessarily,* what makes the difference, if anything, other than luck?

Accidents or Decisions?

The point is that accidents do not cause war. Decisions cause war. Accidents can trigger decisions; and this may be all that anybody meant. But the distinction needs to be made, because the remedy is not just preventing accidents but constraining decisions.

If we think of the decisions as well as the accidents we can see that accidental war, like premeditated war, is subject to "deterrence." Deterrence, it is usually said, is aimed at the rational calculator in full control of his faculties and his forces; accidents may trigger war in spite of deterrence. But it is really better to consider accidental war as *the* deterrence problem, not a separate one.

We want to deter an enemy decision to attack us—not only a cool-headed, premeditated decision that might be taken in the normal course of the cold war, at a time when Russia does not consider an attack by us to be imminent, but also a nervous, hot-headed, frightened, desperate decision that might be precipitated at the peak of a crisis, that might result from an accident or false alarm, that might be engineered by somebody's mischief—a decision taken at a moment when sudden attack by the United States is believed a live possibility.

Either way it takes a decision to initiate war. The difference is in the speed of decision, the information and misinformation available, and the enemy's expectations about what happens if he waits. He must have some notion of how much he would suffer and lose in a war that he starts, and of how much *more* he would suffer and lose in a war that, by hesitating, he fails to start in time. And he must have some notion of how probable it is that war will come sooner or later in spite of our best efforts, and his, to avert it. In deciding whether to initiate war the enemy is aware not only of retaliation but of the likelihood and consequences of a war that he does *not* start. Deterring premeditated war and deterring "accidental war" differ in those expectations—in what the enemy thinks, at the moment he makes his decision, of the likelihood that if *he* abstains we won't.

Accidental war therefore puts an added burden on deterrence. It is not enough to make a war that he starts look unattractive *compared with no war at all;* a war that he starts must look unattractive *even as insurance* against the much worse war that—in a crisis, or after an accident, or due to some mischief—he thinks may be started against him. We have to make it never appear *conservative* to elect the lesser danger of "preemptive" war.

The Urge to Preempt

There is a dilemma, though. Much that we may do to enhance the danger an enemy perceives when he thinks of attacking us also enhances the danger that he perceives in abstaining and risking a war that comes to him on unfavorable terms. In the frantic and ambiguous climate in which a war by misunderstanding might occur, the enemy is *deterred* by the thought of what may happen to him if *he* initiates war. What can happen to him if *we* strike first does not *deter* him; this can lead him to choose the "conservative" course of striking quickly. Ordinarily our "first-strike" capability may not do much to scare him into preventive war, since he may have little reason to impute surprise-attack intentions to us. But "accidental war" refers to a war that he may begin when he imputes intentions to us that make him too afraid to wait. (Or one that we begin when we think that he expects us to and will not wait to see.)

This whole idea of "accidental war" rests on a crucial premise—that there is an enormous advantage, in the event that war occurs, in starting it, and that each side will be not only conscious of this but conscious of the other's preoccupation with it. In an emergency the urge to preempt—to preempt the other's preemption, and so *ad infinitum*—can become a dominant motive. (The term, "false preemption," is sometimes used; but if both sides "falsely preempt," it is not false for either of them.) It is hard to imagine how anybody would be precipitated into full-scale war by accident, false alarm, mischief, or momentary panic, if it were not for the urgency of getting in quick. If there is no advantage in striking an hour sooner than the enemy, and no disadvantage in striking an hour later, one can wait for better evidence of

whether the war is on. But when speed is critical, the victim of an accident or false alarm is under terrible pressure to get on with the war if in fact it is a war.

So is the other country! This is the second reason why the need for speed aggravates the problem: each side imputes to its enemy a similar urgency.

Accident-Prone or Accidental-War-Prone?

Thus the accident-prone character of strategic forces —more correctly, the *sensitivity* of strategic decisions to possible accidents—is closely related to the security of the forces themselves. If a country's retaliatory weapons are reasonably secure against surprise attack, preemptive or premeditated, it need not respond so quickly. Not only can one wait and see, but one can assume that the enemy himself, knowing that one can wait and see, is less afraid of a precipitate decision, less preoccupied with his own need to preempt.

And it is apparent that there can be quite a difference between an accident-prone system, and an accidental-war-prone system. It has been alleged—to take an illustration—that airborne alert is more "accident prone" than ground alert for SAC bombers; let us suppose that it is. Does it follow that airborne alert increases the danger of accidental war? With part of our retaliatory force safely airborne we are less compelled to take precipitate action in the event of sudden ambiguous evidence that an attack is on the way.

It has also been argued that airborne alert is "provocative" or may lead to Russian false alarms leading to war. But there is an opposite tendency, too. The Russians can assume that the main motive for an American attack would be a fear that the Russians were in the process of starting one. The more confident we are that we *could* retaliate against a surprise attack, the less we shall expect such an attack, and the less likely we are to jump the gun; the Russians can be less jumpy themselves.

Warning vs. Survivability

There are two ways to confront the enemy with retaliatory forces that cannot be destroyed in a surprise attack. One is to prevent surprise, the other is to prevent their destruction even in the event of surprise.

Radar, satellite-borne infrared sensors to detect missiles during the burning stage, and the recently reported "bomb-alarm" system to report nuclear explosions in this country the instant they occur, will give us—it is hoped—the few minutes we need to launch our missiles and planes before they are destroyed on the ground. If the Russians know that we *can* react in a few minutes, and that we will *have* the few minutes we need, they may be deterred by the prospect of retaliation.

But hardened underground missile sites, mobile missiles, submarine-based missiles, continually airborne bombs and missiles, and so on, are systems that —hopefully—do not so depend on warning. In terms of ability to retaliate, *warning* and *survivability* are to some extent substitutes; but they also compete with each other. Money spent dispersing and hardening missile sites or developing and building mobile systems could have been spent on better warning, and vice versa.

More important, they *conflict in the strategy of our response*. The critical question is, what do we do if we do get warning? A system that can react within fifteen minutes may be a potent deterrent, but it poses an awful choice whenever we think we have warning. We can exploit our speed of response and risk having started war by false alarm. Or we can wait, avoiding an awful war by mistake but risking a dead retaliatory system if the alarm was real. The problem may be personal and psychological as well as electronic; the finest products of modern physics are of no avail if the top-ranking decision-maker, whoever he may be, within the time available—is too indecisive, or too wise, to act with the alacrity of an electronic computer.

So the choice between spending money on better warning, and spending money on systems that *depend* less on warning, is a real choice, and one especially pertinent to inadvertent war. And again, we get double security out of the system that can survive without warning: The Russian knowledge that we can wait in the face of ambiguous evidence, that we can take a few minutes to check on the origin of accidents or mischief, that we are not dependent on instant reaction to a fallible warning system, may permit them, too, to wait a few minutes in the face of an accident, and permit them at the peak of a crisis to attribute less jumpy behavior to us and to be less jumpy themselves.

Arms Control and Accidental War

Accidental war is often adduced as a powerful motive for disarmament. The multiplication and dispersion of ever more powerful weapons seems to carry an ever growing danger of accidental war; and many who are confident that deliberate attack is adequately deterred are apprehensive abou' the accidental-war possibilities inherent in the arms race.

But there is a conflict—and a serious one—between the urge to have fewer weapons in the interest of fewer accidents and the need—still thinking about accidental war—to have forces so secure and so adequate that they need not react with haste for fear of being unable to react at all, and that the enemy has enough confidence in our ability to be calm to be calm himself. A retaliatory system that is inadequate not only makes the possessor jumpy but is ground for the enemy's being jumpy, too.

It is important to keep in mind, too, that (as in any other business) accidents can be reduced by spending more money. To correlate weapons, accidents, and arms budgets, ignores the fact that the security of, control over, and communication with, one's retaliatory forces is an important and expensive part of the military establishment. For a given number of weapons, more money may mean more reliable

(Continued on following page)

communications and command procedures. Skimpy budgets can mean skimpy protection against malfunction, confusion, and mischief.

But if we get away from the notion that arms control means simply the elimination of weapons, and search instead for cooperative arrangements that may reduce the likelihood of war—whether they cost more or cost less, involve more weapons or less weapons (or just different kinds of weapons)—and if we recognize that the security we and the Russians both can achieve may be enhanced by some kind of cooperation, there probably are things to be done jointly to reduce the likelihood of "accidental war."

This was stressed by Secretary Herter in his speech of February 18. He pointed out that "observers might prove useful, during a major crisis, helping to verify that neither side was preparing a surprise attack upon the other." "Other arrangements," he said, "for exchanging information might be developed to assure against potentially dangerous misunderstandings about events in outer space."

To be sure, it is not obvious that observers could prevent "miscalculation"; furthermore, to the extent that observers help an enemy target one's own retaliatory weapons, or help the enemy to know when they are momentarily disabled for one reason or another, observers could be harmful. Nevertheless, exchange of facilities for some kinds of surveillance and warning can perhaps improve both sides' warning systems, particularly with respect to false alarm. Furthermore, in the event of literal accidents, or possible mischief by a third party, there may be an important *reassurance* process by which we and the Russians could verify—if not just what kind of an accident it was—at least that neither of us was reacting on the assumption that it was more than an accident. Just alerting the enemy to the fact that an accident has occurred, asking him to sit still until the dust settles, letting him know that we know it was an accident, may cause him to react with less alarm than if he had to guess what was going on and how we were interpreting it.

Synchronized Relaxation

An important problem, if an emergency ever arises, will be working out a synchronized relaxation. If both we and the Russians, in the face of some accident or incident, recognizing that war may be imminent, go temporarily on an extraordinary alert status, the question of who relaxes first can prove a genuine problem. Each side, as long as it maintains extraordinary alert, may substantially deter attack; but each is in a good position to attack if the other prematurely relaxes. Furthermore, a posture of extraordinary alert may be one in which misunderstandings, false alarms, and literal accidents, are more likely to occur, and are more likely to be interpreted as significant. Facilities for quick negotiation of a synchronized relaxation could be extremely important; equally important would be having thought ahead of time about what kind of relaxation schedule would be both acceptable and reassuring to oneself as well as acceptable to the enemy.

Finally, under the circumstances each side might submit to kinds of surveillance that would be infeasible, unpalatable, or too expensive, in the ordinary course of cold-war mutual surveillance. Being able to improvise, or to call into action some available facilities and personnel, when the motives on both sides are to demonstrate compliance sufficiently to make some understanding possible, could be of crucial importance. Assuming both sides are aware that the emergency is over, but both recognize that they are trapped in extremely unstable positions, each may submit temporarily to a surveillance that ordinarily he would never agree to, on condition that the other temporarily do likewise.

It is difficult to describe such emergencies in advance and to predict the status of forces on both sides sufficiently to design in advance an ideal standby inspection scheme that could be called on under the circumstances. But some adaptable, flexible facilities and personnel, available to see with their own eyes what the host country invites them to see and to report authentically at home what they have seen, when the host country's motives are to provide positive evidence sufficient to reassure the enemy, is a worthwhile idea and not a terribly expensive one nor one that necessarily involves acute political difficulties.

"Crash" Disarmament

The "accidental war" contingency also suggests how arms control of a serious kind may eventually come about, if it ever does. There is presently no evident serious belief among the leaders of the USA and the USSR that arms control offers an important alternative to a grave danger of war. There is no desperation on either side, hardly any urgency, little imagination, much attention to short-run propaganda, and too little logical consistency between each side's disarmament proposals and its national security policies to suggest that we are near a turning point in the history of arms control.

Things would be different if an accident, a false alarm, or a misunderstanding, sent us both hurtling to the brink of war. It might not be easy, or even possible, to return to the *status quo ante*. One thing that currently keeps the balance of deterrence somewhat stable, reduces the fear of preemption and hence the urge to preempt, and reduces the incidence of false alarms, is sheer inertia, lack of initiative, lack of imagination about the reality of war. But if an acute crisis occurs, and both sides demonstrate unmistakably that they are prepared to go, or may get drawn, to the brink of war, *and that they now attribute to each other a readiness to attack*, the situation will be altogether different. This would be especially true if in the emergency both perceived that the only thing restraining the other was a temporary (and perhaps not durable) superalert status that had made surprise momentarily impossible, and that each would proceed henceforward on the assumption that the other would strike at the first good opportunity.

In these circumstances both sides might recognize that the balance of deterrence had become genuinely and irreversibly unstable. It is at this point that "crash disarmament" might suddenly become an important alternative to a nearly inevitable war. Just getting away from the brink may require collaboration; but if expectations have been permanently altered, and confidence has been destroyed, more is required.

The "more" is presumably an improvised, but potentially permanent, synchronized establishment of some "measures to safeguard against surprise attack," more potent and drastic than any that have yet been discussed—if on the occasion any such measures are known and have been sufficiently anticipated to be feasible.

When arms control is suddenly desired it may not be able to wait. Preparing, in ideas and material, for the contingency—for a sudden improvisation of arms control—could be crucial on the occasion when arms control becomes a possibility and a necessity.

Limiting the Consequences

An anomaly of "accidental war" is that if it occurs one side or both may know that it was accidental or at least suspect that it was. This could affect our punitive attitude. We might feel less vengeful in retaliation, and more concerned to preserve the United States, if we thought that the war had been provoked by an incident or misunderstanding (and especially if we had been the ones to start it).

What matters is whether this affects the way we wish to conduct the war. If the concept of "accidental war"—or whatever we choose to call a war that is not initiated altogether deliberately—has any meaning, it is probably a war in which our urge for revenge and retaliation is less than our urge to curtail the consequences of the error, regardless of whose error it was. If our object, in the event war should come, is to save as much of the country as possible and to provide for its further security, we should think not only about how to deter war, and how to enter it most effectively if it comes, but how to terminate it to best advantage.

A possible strategy is to strike at the Russians in all fury, punishing millions of them for the misdeeds of their leaders. Another is to go after their military forces, if we know where they are and can get there quickly enough, hoping to destroy them before they destroy us further and hoping to reduce the enemy to military impotence. But a valuable asset, in case we are attacked, is live Russians rather than dead ones, and our own unspent weapons. The threat of what we can *still* do to the enemy may be our greatest strength. If we failed to deter his initial attack (or if the initial attack was ours) we may still deter his prosecution of a war that he has already lost, or of a war in which the best he can do is break even. Especially if the war started by an "accident," or if the Russians attacked for fear that we were about to attack them, our interest in punishment should be less than our interest in ending the war and disarming the enemy by the *threat* of continued action.

This possibility is most plausible if we recognize that, contrary to popular expectation, the enemy may feel that he cannot afford in his initial strike to waste valuable weapons on low-priority targets like American cities—at least if we have so located our strategic forces that he does not have to destroy our cities in his vain (or successful) attempt to get them, and if we have made some provision for protection against fallout.

Not only might cities be low-priority targets in the strategic sense, but he may go to some risk to avoid them if he thinks we can recognize his restraint and react to it. Just preserving some choice for this contingency—just being able, if we wish, to fight anything but a war of extermination—to keep open the possibility that we can demand his surrender or disarmament, limit the general war and bring it to a close, requires that we have the military ability to do more than go after the enemy in a single spasm, and the organizational ability to communicate something more than a quick "go" signal to our strategic forces at the instant war seems to be on. It requires that we be able to preserve some of our forces and our control over them for hours, days, or longer.

(This, of course, does not mean no retaliation. It may mean a more sophisticated course of retaliation than is usually assumed, retaliation in impressive but measured doses, and in a meaningful pattern that preserves with each act of punishment the promise of more.)

There is a genuine dilemma. If we appear to be capable of conducting a war with control, capable of withholding damage to use the further threat of it in coercing the enemy, capable of responding to how he conducts himself in a general war, and conscious of the possibility of "intrawar deterrence," we possibly weaken our "prewar deterrence." We may encourage the enemy to reduce his estimate of the "cost" of general war, by lowering the risk in case things go wrong. Just being able, for example, to accept his surrender may suggest that surrender is the worst outcome he has to consider in deciding on war. While this is a valid argument, it is not necessarily conclusive.

Even for "prewar deterrence" it is not obvious that the most effective threat is instant punitive destruction without regard to ourselves. To deter or forestall the unpremediated attack—the "preemptive attack," or the "accidental," "false-alarm," or mischief-inspired attack—we ought to cultivate the enemy's belief that we shall respond to what may be the opening moves in a general war with deliberate care and control and sensitivity to what is going on, not with an instant, all-out, indiscriminate effort to destroy all the enemies who may have been involved.

So if we want to avoid foreclosing the possibility of using our surviving retaliatory capability as an instrument of coercion; if we want to retain an option of limiting the war; even if we just want to be able to receive the enemy's surrender in case his attack goes badly; we need strategic forces that do not have to go off like a match in a fireworks factory when the lights start flashing.—END

"All scientific developments today point to the predominance of aerospace in the weapon systems of tomorrow," said the Secretary of the Air Force at the recent AFA Convention in San Francisco. To meet its responsibilities, USAF will continue to think in terms of both manned and unmanned systems with the recognition that . . .

SECURITY IS AEROSPACE POWER

The Hon. Dudley C. Sharp
SECRETARY OF THE AIR FORCE

ONLY five years ago, when I first came to the Air Force, B-47s and B-36s were the mainstay of the strategic force. The Air Force had no ballistic missiles—as a matter of fact an earnest effort to develop them had just gotten well under way. B-52s were just beginning to come into the inventory, the B-58 was only in the development stage, and the F-100 was the only operational Century-series fighter. The Pine Tree and Mid-Canada lines were not yet operational and the DEW Line was not yet constructed. SAGE was not in operation, BMEWS was far in the future, and almost nobody outside of a few scientific circles dared to talk about such things as space vehicles and satellites.

The Air Force has made dramatic progress since 1955. By concentrating its effort on the most powerful weapons and the most effective delivery systems, it has created an unequaled aerospace capability. To recap the progress, let's take a bird's-eye look at where we are today.

In the strategic area, operational Atlas missiles are at their sites, ready if needed. Titan is scoring consistently well at this stage of its development. The Minuteman program has been accelerated to one year ahead of its original schedule. The Hound Dog missile has been added to SAC's B-52s, and the program leading to Sky Bolt is well under way.

The Air Force has continued development of the airframe and major subsystems of the B-70, and has just recently redirected its efforts to the development of a complete weapon system. I am confident that additional 1961 funds will be expended on this program and that it will be well supported in the FY '62 budget.

Funds have been allocated and procurement begun which will provide us an on-the-shelf capability for an airborne alert, if needed.

Building the force structure is one thing. Using it is another. The destruction of military targets with the speed and decisiveness that the force structure makes possible is something that cannot be approached in a haphazard fashion. To guarantee the effective use of this force, the recently announced Strategic Target Planning Staff ensures a centralized target planning function. It also provides for coordinated execution of war plans by the commanders who are directly concerned.

In this way, all of our atomic strike capabilities can be assigned specified targets which are compatible with each system's most effective employment.

Turning now to our tactical capability, through repeated tests of "no-notice" deployment, Composite Air Strike Forces have demonstrated a capability to reach any trouble spot in the world within sixteen to seventy-two hours. The F-105 tactical fighter is operational and now in TAC units. For those of you who are statistically minded, this fighter carries more firepower potential than thousands of B-17s. The programed number of F-105 wings has been more than doubled. Our overseas air forces in Europe and the Far East are readily available to conduct limited-war operations anywhere in the world.

In the air defense field, major new elements added to our SAGE system have tripled the area of the United States covered by this sophisticated automatic control network. Four squadrons of Bomarc-As have been added to our active air defense system, and the major problems in the Bomarc-B program have been corrected. Also, the system's manned interceptor capability is appreciably greater than it was a year ago, in view of nuclear-armed rockets and supersonic fighters.

The Thule BMEWS site will become operational soon. Construction at site two in Alaska is moving ahead on a revised and accelerated schedule, and it will become operational next summer. Site three in the United Kingdom will come in a year later.

In the satellite programs, we can all be proud of the success with the Discoverer series, with the initial work on Midas and Samos, and with those satellites the Air Force has launched for the other services and for the NASA—including the Pioneer, Tiros, Transit, and Echo systems.

The over-all strength of the US and its allies is greater now than it has ever been. There have been a good many people honestly concerned about our military posture, particularly for the next few years in view of the rapid progress made by the Soviet Union

in developing long-range guided missiles. While the Soviet advance in this one field has been remarkable, the important thing to remember is that at no time, presently or in the future, will their total strategic capability equal our own. Thus, there is no deterrent gap, and, if we follow our presently approved plans and programs, there will not be a deterrent gap.

Our SAC bombers and ICBMs are the major elements of our deterrent force, but they are by no means all of the counterstrike force the Soviets would have to destroy if they chose to attack us. The Air Force, its sister services, and the free world can employ other significant systems whose capabilities are well known to the USSR.

Furthermore, and this is important, the Department of Defense has attained this position of strength within budget figures on which it and the Congress were actually in almost exact agreement. In this fiscal year, for example, the budget finally approved by Congress was only about one and one-half percent more than that originally requested by the Department of Defense and the President.

Strong as it is, however, the Air Force has not reached a plateau. Further, its future course is not clear-cut and easily preplanned. It may be a cliche to mention the rapid advances of science and technology; but from a military standpoint this is one of the most significant facts of the age we live in. Picking the right weapon system to place money on is one of the most difficult tasks of the Air Force today. For what we do now will determine our effectiveness in the future.

I am sure it is perfectly clear to everyone that it is not possible to choose any one weapon or delivery system, and rely on it completely to defeat the enemy. There is no such thing as an ultimate weapon, and it is folly to identify any single weapon system as being invulnerable.

While it is impossible to say with accuracy what any one given inventory may be, there is one general observation which I believe is of particular importance to this audience. All scientific developments today point to the predominance of aerospace in the weapon systems of tomorrow. We will go through phases of launching them from different platforms and controlling them differently, but in the long run, aerospace is the dominant medium today and it will be tomorrow.

The Air Force has no intention of setting its sights on anything less than a force that will be powerfully decisive. We must be prepared to win should deterrence fail. There is no safe alternative now or in the future.

In line with this intent, the Air Force will continue to think in terms of a blend of both manned and unmanned aerospace systems. We can never consider that it is a matter of either missiles or bombers, since obviously both have their specific applications.

Incidentally, despite the Soviet propaganda claims about how many rockets they have and what they can do, we know they are now testing their first supersonic bomber. This is strong evidence that the Soviets also realize that both manned and unmanned vehicles are essential.

I will not predict for any given time what our force structure will be as to proportion of manned vehicles and missiles. For one thing, we are reaching out toward the B-70 cycle of strategic bombers, which represents a major breakthrough in aerodynamic design and which offers an enormous growth potential. But this is by no means the end of the line for manned systems. Man has always been the essential element of any weapon system. He will continue to be for as far into the future as we can see.

To emphasize this point—the Air Force is pushing the Dyna-Soar program with the long-range goal of pointing the way for an entirely new cycle. On drawing boards now are concepts for vehicles that can orbit, reenter and operate in the atmosphere, and return to an orbital path at the will of the pilot. There is much research to be conducted before such concepts can become Air Force programs, but efforts are definitely aimed in that direction.

The Air Force is also taking a close look at promising missile concepts to follow the Minuteman. These may be very small, long-range missiles that could, with refined warheads, carry extremely high-yield payloads. On the other hand, they may be the very large missiles, possibly with multipurpose warheads.

As for satellites, the Midas, Samos, and Discoverer programs represent only the first step in the direction of creating such vehicles to perform military missions. We in the Air Force are not interested in stunts purely for propaganda, but we are vitally concerned with such useful developments as communications, surveillance, and early-warning satellites. The Air Force has a vital role in space and I am confident that we will fulfill it with the same vigor that has characterized our work in both the manned bomber and missiles fields.

In so doing, the necessary weapon systems will become more complex. Costs for them will continue to rise and this is a fact of life we have to face up to. It would be foolhardy to say the next cycle of weapons will cost less per copy than our present ones.

An important point which is often overlooked in the difficulties we are experiencing in transitioning from aircraft to missiles and space weapon systems is that we are spending more at an unprecedented peacetime rate. Our total defense expenditures for this fiscal year will be higher than for any other peacetime year in history. They will inevitably be even higher in years to come.

We have no other secure course to follow. We must have the necessary systems. To keep total defense costs within reasonable economical limits, we must continue improving management. We must achieve a healthy pattern of productivity and we must get more for our defense dollar. The Air Force-industry team must meet the future challenges with all the energy and dedication we can muster.—END

Mr. Sharp has been Secretary of the Air Force since December 1959. He was appointed Assistant Secretary of the Air Force for Materiel in 1955, returned briefly to the presidency of the Mission Manufacturing Co., Houston, in 1959, then became Under Secretary of the Air Force. He held that position until named to his current post.

"Effective deterrence," declared USAF's Chief of Staff at the 1960 National Convention of the Air Force Association, "includes the possession of military forces to deter war and, should war occur, the military strength to prevail." Should our power wane, Communist dominance would be a certainty. We must, in sum, face up to the realities of . . .

LIVING WITH DANGER

Gen. Thomas D. White, USAF

CHIEF OF STAFF,
UNITED STATES AIR FORCE

AIRPOWER has been my profession, my hobby, indeed my life, for going on forty years. While I can't claim to go back to the day of the Wright brothers, I did serve my apprenticeship under Billy Mitchell's generation. I was a first lieutenant of infantry that famous summer of 1921 when he led the bombers which sank the warships anchored near Cape Charles. To many a young fellow like me it truly seemed then that something altogether new was being added to the power and reach of nations. And in the years that followed, many of us in this room were to witness and even share in the immense consequences that flowed from the concepts put to test off Cape Charles. Out of it all came a profound reshaping of national strategy, a great new and independent military service, and a new industry with its roots in practically every corner of America.

A quarter of a century later I was to become aware, as you were, that a cape of another name was destined to provide us with still another dramatic landmark—Cape Canaveral in Florida. Things were happening there that conceptually were as fresh, and in their implications as revolutionary, as had been the experiments at Cape Charles years before.

And then, only six weeks ago, an event which had its beginning on the opposite coast of this vast nation—at Vandenberg Air Force Base—ushered in the dawn of a new and, I am convinced, equally revolutionary era. The capsule of the Air Force's Discoverer was successfully recovered—the first man-made object ever retrieved from orbit.

Within these forty-odd years equally great upheavals in the political and economic scene have had their impingement on the military. World War I had just come to a close; the October Revolution was a fact, its significance scarcely dreamed of; World War II, the advent of Communist China and then Korea followed in what now seems a fantastically short time.

From a military point of view perhaps the net of it all has been the twin power factors of the USSR and Communist China—the most momentous military fact of our times.

It is hard to believe that Russia, for example, a relatively backward nation, and one, moreover, that was shattered by war less than two decades ago, could have moved so fast into so wide a variety of military technologies. In the span of fifteen years, their technicians have mastered, first, the long-range piston bomber, then in quick succession—the long-range jet bomber, the long-range ballistic missile, the orbital Sputnik, and the remarkable Lunik that hit the moon.

I can remember when things were otherwise in the USSR. In 1934 and 1935, I was stationed in that country as our first air attaché. I flew over parts of their country, visited a number of their airfields, and even was taken up in some of their military aircraft. Although much of what I saw was unimpressive, quantities were great and the seeds of technical initiative were beginning to bear fruit.

I recall, as well, when the military power of China was almost comical. I served in that country during the civil wars of the late 1920s. One day at lunch, while on a trip to Manchuria, I was invited by a local warlord to witness an engagement that he proposed to fight later in the afternoon against another warlord with whom he was ordinarily on excellent terms. The plan of battle that my new acquaintance had prepared called for a surprise move against the enemy's rear in an armored train. A group of us motored into the countryside to watch the battle from a convenient hilltop. The enemy forces were scattered over a valley, ripe for defeat. But the armored train never appeared. It developed later that when the engineer was commanded to move, he was unable to raise steam. The boilers had been drained to provide hot tea for the troops. So far as I know, the battle was never fought.

There is nothing comical about mainland China today. And it would be a foolish man who claimed that Soviet Russian power is second-class today. Furthermore, in looking back across the transformations that have occurred in the two Communist power centers in my own day, I know without a shadow of doubt that Communist aims are fixed on the acquisition of absolute power in all organized forms, whether military, political, or economic.

It used to be said in less complex times that only two things were really certain in this life: death and taxes. Our generation has to learn to live with another certainty as well: the certainty of Communist domination should our power ever wane and should our sense of purpose ever falter. Thus, for some time to come, the free world will be forced to recognize and live with a certain amount of risk, a circumstance which is by no means new. As between this risk and the certainty of Communist domination, most self-respecting men and women throughout the world will, I am sure, accept the risk. Whatever the risk may be, it is my deep belief that, given the best resources of the West, the margin of danger for us can be kept within tolerable bounds. But keeping it so will manifestly require of us unceasing effort through a period of flourishing invention. That effort will be costly in money terms and in human terms. And, above all else, we shall be required to understand the meaning of deterrence and the apparatus required to make it work—for deterrence is the key to reducing the margin of danger.

At this point, it might be useful for us to reflect a moment or two on precisely what deterrence does mean—particularly so since our survival almost certainly depends upon how we go about it. As I see it, effective deterrence includes the possession of military forces to deter war and, should war occur, the military strength to prevail. There are two key thoughts here: deter and prevail. It might appear that this is a contradiction since the ability to prevail in war is needful only if our policy of deterrence fails. Nevertheless, the ability to prevail is what provides real and effective deterrence.

I have emphasized the word prevail because the concept of deterrence, as interpreted by some, is merely the possession of military strength which could inflict severe and perhaps indiscriminate punishment upon an enemy. Apparently, they disregard the need for military strength sufficient to defeat him. They seem to feel that a suitable deterrent can be contained in military strength which is sufficient only to hurt an enemy—while leaving his weapons free to destroy us. This approach to national security is diametrically opposed to man's experience throughout all military history—and I cannot agree with it. If deterrence fails and a nation must fight, it wants—and must have—the strength to win.

There are those, of course, who hold that a nuclear stalemate exists, or is imminent, and that this situation precludes the use of nuclear weapons by either side, under the risk of inviting unacceptable destruction. From this assumption, and it is no more than an assumption, some argue that the US and its allies should retreat from a nuclear strategy and start reconstructing its so-called conventional forces on a greatly increased scale. There are those, additionally, who read another meaning into the stalemate hypothesis. It is that the Russians have recognized that war no longer offers a profitable avenue for further expansion, and they are therefore reducing their military forces and redirecting their efforts on the political and economic flanks. Finally, there are others who hold that because of the vast destructive power of nuclear weapons, the essential purposes of deterrence would be satisfied by rather small and presumably invulnerable forces.

On the surface, these arguments appear to have merit. However, upon closer examination certain facts become apparent. First, a stalemate in today's era of astonishing technical advances is not a long continuing probability. Who can say, in the light of recent developments, what technological breakthroughs will occur tomorrow? We cannot pace our advance or establish our strategy on the *status quo* approach. Secondly, although I believe that the Soviets are reducing their military forces as advertised, it is with the express purpose of taking full advantage of new weapon technology—not of reducing their over-all military power. Furthermore, I for one am absolutely con-

(Continued on following page)

vinced that the Communist bloc will use whatever avenue is most open to their goal of world domination—political, economic, or military. Lastly, should we depend upon minimum deterrence we will, among other things, strip this country of any political, diplomatic, or military initiative.

All of this means to me that the free world must be superior to the Communist bloc in decisive military power. Allied nations must prepare and maintain the military strength to accomplish the overriding task—the task of destroying the military strength of the Communist bloc—if war is forced upon us. And in this task no single weapon or type of weapon can accomplish the job; nor does one service or one nation stand alone. We need complementary weapons on land, at sea, and in aerospace—a combination of forces designed specifically to provide the free world with the flexibility and varied capabilities which it requires.

Allied land, sea, and air forces worldwide do, in fact, represent substantial and versatile strength today. Some five million active Army troops and over two thousand combatant ships join with approximately thirty thousand aircraft as evidence of this effort. These forces, in conjunction with the military power of our own deployed Army, Navy, Marine, and Air Force units, comprise a forward strategy to meet force with force. At the same time, I would point out that the strong right arm backing up these forces—the military muscle, which could, if called upon, destroy the very heart of enemy military strength—is contained chiefly in the striking power of the United States Strategic Air Command. No area on the surface of the earth is immune from the tremendous influence of its truly global capabilities.

All of us know that airpower, in World War II, changed the course of history. And I am convinced that history likewise will reflect the change wrought by the tremendous potential in the expanding characteristics of aerospace power. It behooves us—the free nations of the world—to assure that this history is written as we would like it to be.

The rate and extent of our advances in aerospace activities in the years ahead will be contingent upon many factors including, of course, the state of the art and the amount of money and effort expended. But, equally or perhaps more important, will be the degree to which we are successful in removing the restraining hand of tradition from the throttle of progress.

We can never be satisfied with things as they are. In the past, lack of vision has grievously retarded progress and, incidentally, this failing has not been confined to just one service or to our own country. Let me give you some examples.

The Russians now claim that they flew an aircraft as early as 1882—some twenty years before the Wright brothers' Flyer lifted off the sands of Kitty Hawk. We can discount this claim, but I *can* point out that the Russians were among the first to capitalize—if I may use that word in describing them—to capitalize upon *and* to ignore the potential of the airplane. In fact, as early as 1913, the Russians developed the first successful four-engine plane, and by 1936 the Soviet Air Force had a large number of four-engine aircraft. Nevertheless, the record of Soviet bomber accomplishments in World War II was inconsequential because progress in their concepts of employment did not parallel their technological advances.

All of us are familiar with the efforts of Generals Mitchell, Arnold, Spaatz, and others to gain recognition for American airpower's potential. Yet, as late as 1937, our own War Department halted the development of large bomber aircraft with the ruling that bombardment planes should be lightweight, less expensive, and limited to a 300-mile range. As a result, on the September morning twenty-one years ago which marked the start of World War II, the United States possessed only fourteen heavy bombers.

Even today, I have detected similar lack of vision and appreciation for the role that aerospace power can be expected to play in the future. We should welcome critical examination of the various elements that make up aerospace power and we can expect heated arguments in such discussions. Nevertheless, the true measure of an understanding of aerospace power is the awareness of its basic characteristics and an open-minded approach to the possibilities that lie before it.

New technological highways to fantastic weapon performance lie ahead—some leading to advanced aerospace weapons, others leading to more effective means of waging land and sea warfare. We must concentrate, however, on the programs which, in total, will provide the free world with the most security. In doing so, we must avoid the trap of pursuing a wide variety of projects to further vested interests.

Which paths should we follow—and in what priority? If we had unlimited time, effort, and dollars we could follow all of them through to an expeditious military application—simultaneously. Unfortunately, neither time, effort, nor dollars are unlimited. Thus, the answer must lie in a realistic approach to the direction our strategy should take to best serve the interests of this nation and the free world as a whole.

As we look to the job ahead, everything points to the fact that this nation must be preeminent in aerospace if free world security is to be guaranteed. Recent Air Force accomplishments in connection with its ballistic missile programs, the X-15, and the Discoverer satellites are good indications of progress. But these successes are, in fact, only the beginning. The integration of the complexities of aerospace power into sound strategy and proper forces in the face of mounting enemy capabilities places an awesome responsibility on the Air Force. I can solemnly assure you that the Air Force's staff and commanders are deeply aware of this. I pledge you and the nation theirs and my dedication to one forthright purpose—America's national security.—END

General White has been Chief of Staff, USAF, since July 1957. His prior military career, stretching back to 1916, included attaché duty in Russia and China, combat commands in the Pacific in World War II, and more than a decade in top-level Hq. USAF posts including Director of Plans, DCS/Operations, and Vice Chief of Staff.

Our strategic concepts have come a long way since World War II. Today, we know that we must maintain a strong and vigorous deterrent capability, an acceptable level of air defense, and multirole tactical air strength. So said TAC's Commander at AFA's National Convention in San Francisco as he examined . . .

OUR AIRBORNE TRIPLE-THREAT FORCE

Gen. Frank F. Everest, USAF

COMMANDER, TACTICAL AIR COMMAND

AFTER World War II all US forces suffered the consequences of a rapid and even hysterical decline in our total military strength. At that time, we in the United States enjoyed a monopoly of a weapon of tremendous potential, the atomic bomb. We also had developed and were improving delivery capabilities of extensive dimensions.

The combination of these two things, the bomb and the long-legged means of delivery, posed an awesome potential, so awesome that it became an instrument of national policy. And for the five years following World War II, between the end of World War II and Korea, it was, in fact, such an instrument in our national policy to an extent greater than most of us realized.

In many areas it was wrapped around this particular combination. The consequences of this thing were several:

The general consensus of those allegedly expert in these matters was that, if a third world war came, it would be an all-out world war involving an intercontinental exchange of tremendous proportions or else no war at all. Military alliances were considered of relatively small importance or quite unnecessary. The threat to use the atomic bomb was, in itself, deemed to be sufficient to halt all forms of aggression, and there was good reason for holding this opinion.

In the years immediately following World War II, the President of the United States issued what was in effect an ultimatum to the USSR. He said, in effect:

"You withdraw your forces from the foreign portion of Iran or suffer the consequences."

The Soviets withdrew. In that particular instance, the theory of the employment of the bomb to correct, to adjust, to halt, to oppose all types of aggression was certainly borne out.

Under this situation, it was quite natural and completely understandable why other types of military forces were permitted to dwindle. It was in an era of economy. Cutbacks were the thing. The services were attempting to do their utmost to maintain some semblance of over-all strength within the very drastic limitations that were imposed, and the priority that was accorded at that time to Strategic Air Command and its development was certainly apparent. I have no quarrel with it. But the consequence of the force which it possessed at that time (possessed over conventional means of fighting wars) was not complete externalization, but drastic reduction.

(Continued on following page)

All of a sudden, on the 25th of June in 1950, we found ourselves embroiled in a struggle in the peninsula of Korea. The Soviets violated the thirty-eighth parallel, and undertook an aggressive step against South Korea on that date.

Because of the postwar reductions, the Air Force was not in a proper position to meet that sort of an aggression. The forces in the Far East Air Force, unfortunately, had not only been reduced but had been placed in a posture in which almost all their capability was devoted to an air defensive role.

Now, whether we liked it or not, the theory and the policy which this Administration had been following, had been pursuing for the past five years, was put to test.

In theory this aggression could have been halted by threat of the employment of the atomic bomb. No such threat was made. Many reasons have been offered for the failure, if you call it that, to employ this sort of device in an effort to bring this conflict to a close.

But regardless of those reasons, I feel justified in drawing this conclusion—the United States at that time was unwilling to use such a threat and, therefore, possibly increase the dangers of world conflict.

Over the issues that were existing at that time, it didn't mean our failure. It didn't mean that under different circumstances we might not have done this thing. But very clearly, there was a qualification now in our willingness to employ this threat to achieve our legitimate national purposes, and the qualification was this:

That the issue had to be vital to the United States itself.

These areas of vital interest were not defined, but certainly, one would have been the invasion of any of the territories of our allies in the North Atlantic Treaty Organization; another certainly would have been any attack on the North American continent.

But between those areas of assured reaction and those of a small war in a remote area there was a great difference. There now existed a very definite question of the US's willingness to employ these weapon combinations that we have been talking about in certain circumstances.

Tactical air forces were practically rebuilt in the first few months of the Korean affair. We were able to rebuild them largely because of the resources which reposed in the National Guard and in our reserve components that we inherited from World War II.

By the same token, the aircraft that we had in some quantities permitted us to cover the gap, or close the gap between a real condition of readiness and capability, and one in which we actually found ourselves.

In the areas as between machines and men, there's no doubt in my mind but what the more important resource was the manpower that we had in the Air National Guard and reserves on which we had to call to supplement at that time the pitifully small regular establishment.

I don't need to elaborate on actions which took place in Korea. It was a long drawn-out affair and finally came to an end with a thing called an armistice, but there was no real settlement of the fundamental differences that existed and brought it about.

I have described the major change in national attitude toward the employment of bombs and A-bombs in certain situations, and the qualification as to the national interest in whether or not it was vital. It was evident after Korea that wars of less than general size could occur. One had occurred, that was a lead-pipe cinch, and there wasn't any reason to think that one couldn't occur again.

The performance of tactical air forces, including the reserves which helped to make us strong again, was highly creditable. We operated under great restraints, but nevertheless we operated effectively.

But scarcely was the ink dry on the instrument which brought that war to a conclusion until, strange to say, there was a resurgence of pre-Korean strategy. Responsible people were heard to say that never again would we fight another war like Korea.

I don't know what had been introduced to lead to that sort of assurance. I don't know what guarantees had been offered by our opponents that they wouldn't again undertake a limited military venture, or if they thought it could be kept limited and if they thought that limited political objectives could be obtained therefrom.

I am happy to report to you, and you know it as well as I, that since the end of Korea and the present there has been a vast change in our outlook and an important adjustment in our policies in this particular area. The national policy that followed immediately after World War II, which was concentrated (and understandably so) on almost a single weapon combination, had been changed.

This country adopted a policy of collective military security. We did it deliberately; we did it intentionally. We have followed it consistently without exception since its initial expression in the NATO organization in 1948.

President Eisenhower, in his last State-of-the-Union message, made a rather lengthy statement covering this particular area of policy. I'd like to quote a portion of it where he says:

"Do we forget that our own faith is firmly fastened to these countries? We will not act in any way which would jeopardize our solemn commitments to them. We are now linked to multilateral or bilateral arrangements with over forty nations in this world."

Without going into any more detail with respect to this changing outlook, I am sure that you will agree with me that it's very clear that in addition to maintaining in SAC a strong and vigorous deterrent capability and in NORAD an acceptable level of air defense, there remain three important tasks that are vital in the national interest:

The first of these is to be able to defend our allies and help them defend themselves.

The second is the task of protecting neutral nations, even those with whom we are not bound by any formal treaty arrangement. There is a moral

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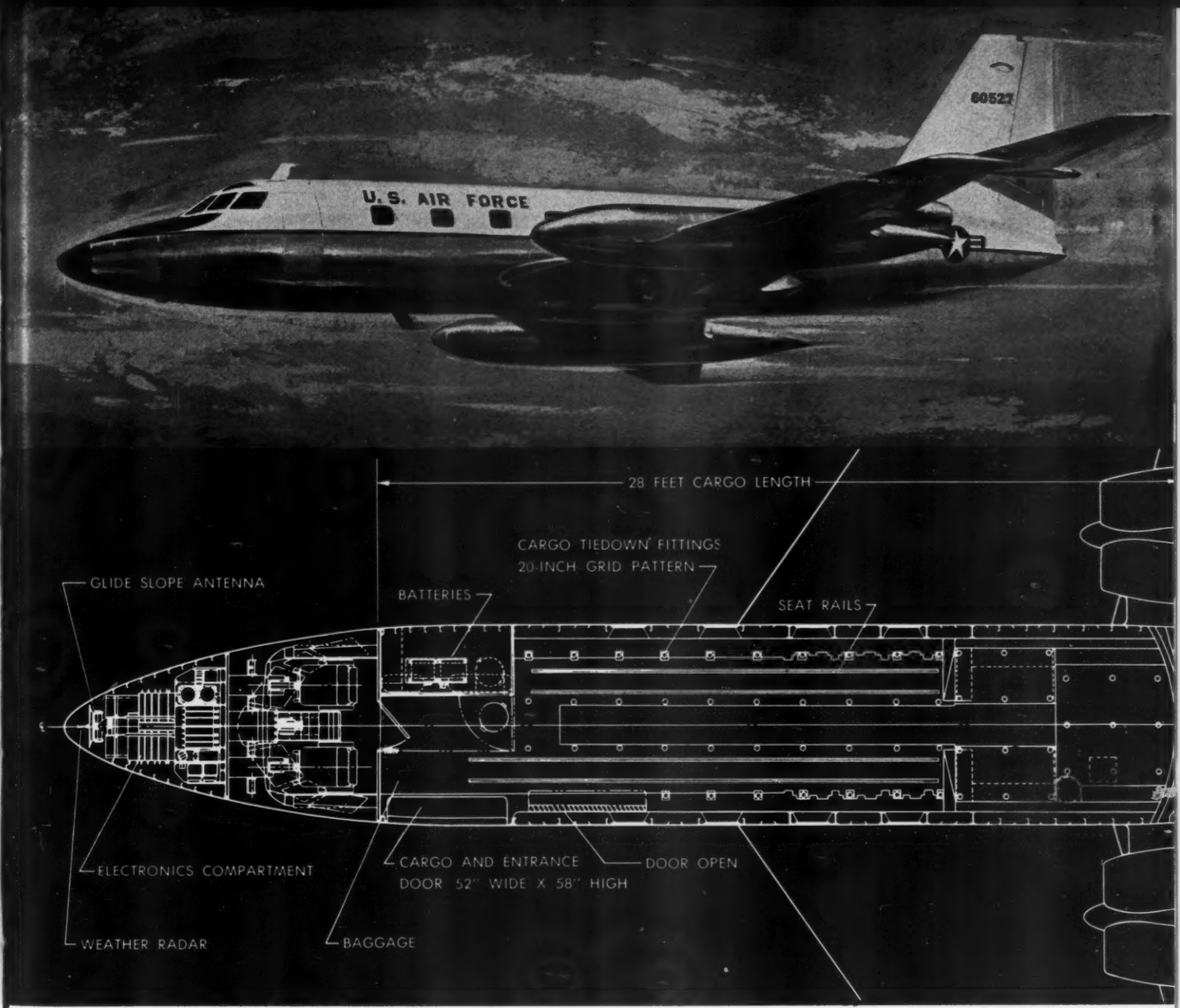

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obligation to do this which we have assumed and which we have declared.

And third, there is the need to be able to counter with appropriate and politically acceptable measures all types and degrees of Soviet-inspired aggression.

Tactical air forces have important tasks in all three of these roles that I have listed.

The fact, however, that there are these chores to be done does not relieve us in the least from the continuing justification that we are obligated to go through of maintaining tactical air forces worldwide as we go down the road in the missile age.

These questions are repeatedly asked:

Why do we need tactical air forces today or tomorrow?

If we need them, in what quantity do we need them?

What are the qualitative problems associated with tactical air forces, and what are the modernization trends?

I think that it's worthwhile to review some of the outstanding reasons—defenses, if you will—which are given in the justification of my command, of PACAF, and of USAFE.

I might say that we aren't hesitant to argue before any tribunal as to the necessity of these types of air forces, and furthermore, it should be necessary for every other aspect of our total military endeavor to be subject to the same sort of scrutiny.

As far as tactical air forces are concerned, the first is the need to present tangible evidence that the United States is supporting its various collective security arrangements, and supporting them actively with things that can be seen, felt, and counted in the areas where their presence is necessary.

My experience in Europe in the two years prior to assuming command of TAC brought this out very, very clearly. An intelligent German, Frenchman, or Dutchman is quite willing to accede that the total strength of the free world includes the tremendous threat of the A-bomb power, the power ready in SAC, but he is not today, nor will he ever be willing to accept that that is the only element of strength that this combination of nations needs, not by any manner of means.

The mere fact that it is based on a continent separated from him by a wet and wild ocean is one thing. He wants a portion of our combined military strength in the land mass that is vital to him. This is understandable, and were we in his position I am sure our attitudes would be identical with his.

The next is the need which anyone can recognize:

To confront the USSR with sufficient strength that there will be no threat of piecemeal seizure and there must be, by the same token, no unopposed seizure. This is the oldest device that aggressors have ever made through the centuries.

The task is simple. You look around for an area of real estate which you would like to seize. You choose one which is undefended or ill-defended. You move in and occupy, and then you are in a position—sitting on the real estate—to say, "Now, we will occupy it."

Hitler's seizure of the Sudetenland was typical of that situation. Anywhere in which a military vacuum exists is a dangerous situation, so whether you view it in terms of a burglar alarm or a plate-glass window or whatever that must be broken before this thing is subjected to seizure, the need to oppose any attempt at quick and sudden seizure, I think, is apparent.

Now, does this mean that we need to have forces everywhere in the world where the Communist bloc might undertake aggression of some sort?

The answer is no, it would be impossible for us to do this. But there are areas of such vital importance to us where the positioning of theater forces is an absolute necessity in the pursuance of national policy. Without it, military alliances go down the drain. They have no meaning.

And in addition to having forces disposed in those areas, it is also equally necessary to have, back here, forces small but highly mobile that can, with the assistance of MATS, move rapidly to any area that might be threatened.

The third—I have touched on it already—is the need to provide an immediate response to any local or small-war threat. That response obviously must either come from theater forces by diversion from their general war task, which is paramount in planning, or it must come from forces here, that is, both from our own Strategic Army Corps (STRAC) and from the Tactical Air Command.

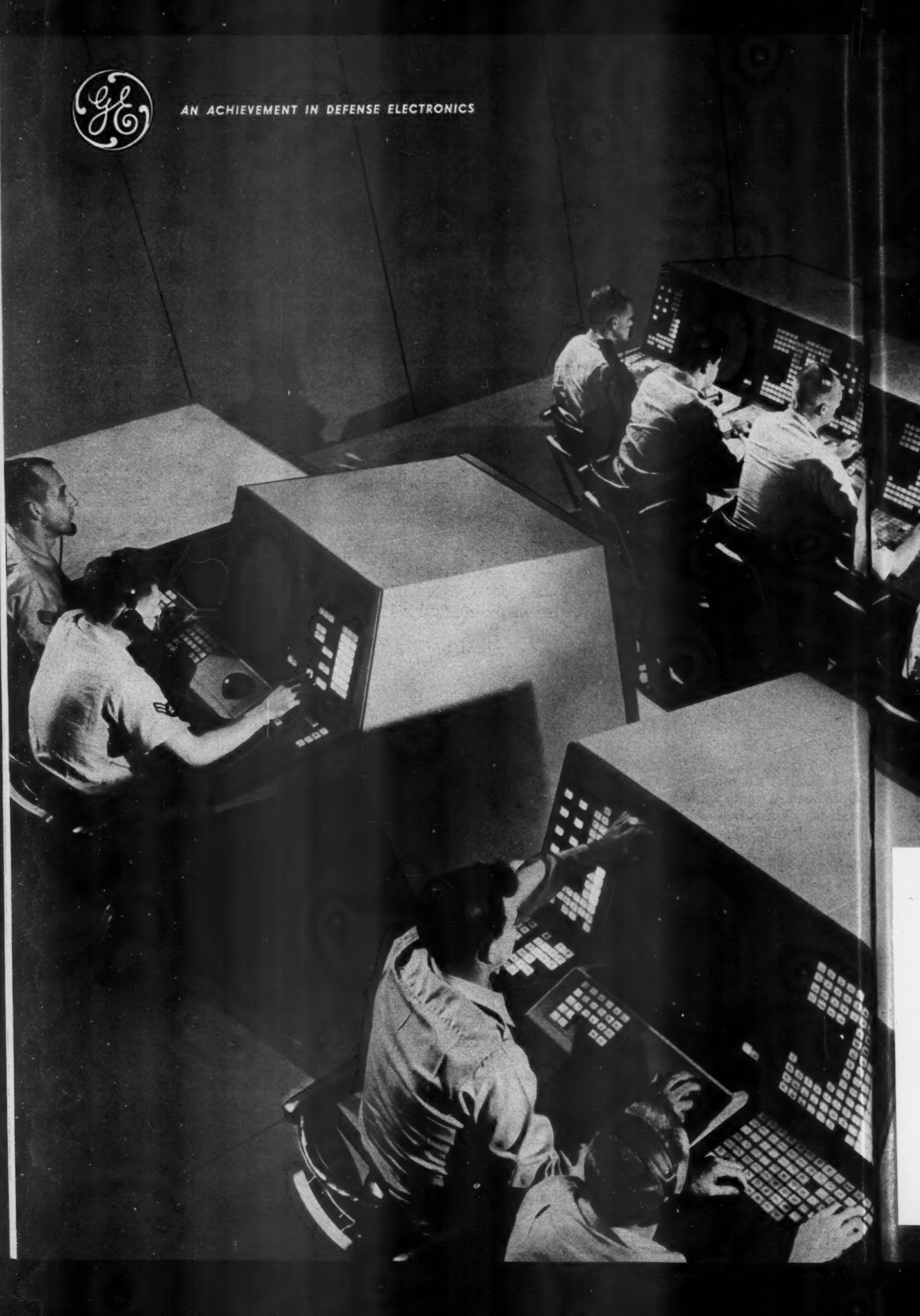
The next is the need to contemplate any plan for general war if he is willing to assume all the consequences of intercontinental warfare. The need of opposing him with a variety of forces and those various forces by the same token must have a global disposition.

The easiest possible solution to an aggressor is to have only one type of force that he must take into account, and then plan an action that provides a high probability of elimination of that particular threat. There are very definite, important, general-war capabilities that derive from the positioning of tactical forces overseas.

One of these is the need to complement and facilitate SAC's operations in a general-war situation through the destruction of certain enemy defense systems which can be accomplished by tactical type air forces.

The last that I will mention here is the need to support the United States' cold-war objectives by being able and by actually deploying highly mobile forces into countries that are exposed by virtue of geographical position and which may be under Communist pressure, direct or indirect. We have done this on more than a few occasions. We are prepared to do it again.—END

General Everest, TAC Commander since August 1959, was formerly Commander in Chief, USAFE, from 1957 to 1959, and DCS/Operations at Hq. USAF from 1954 to 1957. General Everest commanded the FEAF Fifth Air Force in Korea. He saw extensive Pacific service in World War II. He has also been Director of the Joint Staff, Hq. USAF.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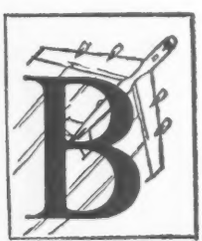
STRATEGY from A to Z

Col. Paul S. Deems, USAF

is for Atom, a particle of matter which yields energy under certain conditions of temperature and pressure. Used in a bomb, Atoms can reduce military objectives instantly, with great savings in manpower and personnel, as opposed to grinding them down with TNT.



is for Bomber, an old-fashioned but accurate means of delivering A-bombs over great distances to destroy opposing aerospace and other forces. Despite its limited altitude and speed, it is reliable, recallable, and has a high degree of intelligence. Bombers can be used in a variety of ways, as Bomber advocates are quick to point out. Missile advocates take pride in the Missile's speed and penetrative ability. Without warning, Bombers are prey to Missile attack; however, Missiles can be used only once. A mixture of the two, in sufficient quantity, is the foundation of Deterrent strength. What constitutes "sufficient quantity" is variously interpreted by Columnists, Generals, Analysts, Admirals, Reserve and Veterans' Associations, various Leagues, Committees and Bureaus, Editors, Politicians, and Candidates for Office. Anybody can be an expert who is not overly burdened with facts.

is for Carrier, a kind of floating runway designed to accommodate the Navy's Air Force. Except when in port, Carriers are useful to defend US naval fleets from attack by other surface forces, such as the British Fleet (which also has Carriers) and to attack land targets from the South.

is for Deterrence, a popular word used to explain how all three Services contribute to ensuring against all-out Atomic war. Deterrence is also described as Finite, or On-the-Beach Deterrence; and Mutual, or Let's-Not-Be-Hasty, Deterrence. Although Deterrence is popularly believed to be an end in itself, it is more properly a by-product of obvious quantitative and qualitative military superiority. Stalemate and Impasse are conditions growing out of indecision about an enemy's real capability, which is secret, as opposed to one's own, which is not. Maximum Deterrence comes from a capability to destroy opposing forces, cities, communications, industry, resources, utilities, and everything between.

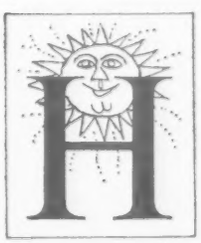
is for Extortion, a form of international blackmail based on the threatened use of Atomic weapons to achieve a political goal. Extortion is only effective when one nation is able to convince another (with an equivalent arsenal) that resolution is synonymous with risk, that the latter increases proportionally with the former, and is not worth the possible losses involved.

Being an Explanation of Certain Terms Uncertainly Used by Lecturers, Statesmen, Writers, Bartenders, Politicians, Reporters, Barkers, Entertainers, and Military Personnel.

And Mastery of Which Will Enable the User to Form Simple But Profound Statements On Highly Controversial Subjects, Such That It May Be Necessary to Leave Before the Check Is Presented . . .

is for Force, and specifically, Military Force. Military Forces are created and maintained—and sometimes designed—in the expectation that they may be used in support of external national policy. Properly designed Forces can be employed in politically useful ways (rendering opposing Forces ineffective by defeat, for instance) without unnecessary hazard to the owning state. Force designed to destroy opposing Force is counterforce. A state may elect to maintain cheaper Forces to frustrate hostile diplomacy by threatening to involve noncombatants. These are called counternation Forces. Counterforce is the more elegant of the two approaches, and at the same time it is also a good deal more expensive.

is for Global, an adjective used to describe variously Strategy, Forces, Communications, Range, Commission, and Atomic War. The importance of the Global, or Round World, concept remained buried from 1942 until the Air Force demonstrated that a Great Circle course is also the shortest route to the USSR. The idea is still not universally accepted by the surface Forces, probably because the Mercator projection is still so popular.



is for Hydrogen, a simple gaseous element found on the sun and in H-bombs. The H-bomb, being much more powerful than the A-bomb, has become popular with military and civilian strategists who believe that much effort and uncertainty can be removed from warfare by reducing the distinction between military and nonmilitary targets. Lofted and delivered by a Missile, the H-bomb makes it possible to eradicate states and obliterate ethnological groups at relatively small cost and with great certainty and speed. By some process of non-Western logic, reprisal in kind does not seem to be a possibility.

is for Invulnerability, an invaluable quality if you have it, and the enemy does not. Static (or defensive) Invulnerability is relative to the weapons which will test it. As weapons, tactics, and techniques improve, static Forces will be

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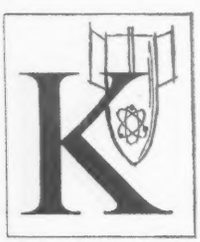
degraded, and mobility and numbers become important. When two nations maintain arsenals of roving weapons, a stalemate will endure as long as neither seeks a means of upsetting the equilibrium. Since communism and Communist technology are both purposefully dynamic, stalemate is not a final plateau, but a delicate condition maintained only by continuous exertion.

is for Jeopardy, a state of the future created by illusion, isolation, an extravaganza of US forces and strategies—and Soviet missiles. While each Service builds on its own concept of General War III, the enemy may display unexpected originality, as he frequently has in the past. Whatever his final strategy, however, operations must be conducted under the essential protection of his aerospace Force. Any sensible US strategy must therefore point to achieving early decision over the opposing aerospace Force, after which joint strategies may be exercised safely and for as long as necessary.

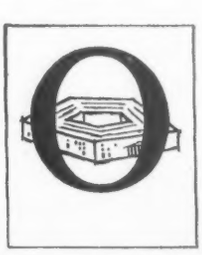


is for Kiloton, a convenient method for equating the power—or yield—of an Atom bomb to the easily understood TNT equivalent in thousands of tons. Assuming that the average citizen is familiar with the effect of 40,000 one-thousand-pound TNT bombs dropped simultaneously on one target, he can then readily visualize the effect of a "nominal" Atom bomb. It takes 500 "nominal" bombs to equal a ten-megaton Hydrogen bomb. A 500-pound TNT bomb is equal to .00025 Kilotons. The economy of the larger size is obvious, provided suitable targets exist to justify its use. A .00025 Kiloton Atom bomb would permit an Atomic War to be fought at conventional rates, which would go some way toward reconciling opposing viewpoints on future wars.

is for Limited, generally used as an adjectival modifier for a kind of infantry exercise, in an unpronounceable place, with one-at-a-time weapons. For those Force elements which have the least nuclear capability, and the smallest chance of surviving in any conflict where Atomic bombs may be used, Limited War furnishes a rationale for their existence. Limited War (or Conventional) proponents minimize logistics, casualties, and expense; and most of all the proposition that only unquestioned General War superiority can inhibit the aggressor in his choice of weapons. A Conventional War capability resting on a limited Atomic deterrent is a short-cut to Jeopardy.

is for Massive, as in Massive Retaliation. Various refinements and redefinitions of Massive Retaliation have encouraged the individual user of the expression to interpret it according to his own bias. Most popularly, Massive Retaliation means "overkill" (or SAC, if you are in the Army or Navy). The connotation of wanton destruction by supersized weapons has caused it to lose its flavor for the Air Force and the general public as well, especially since the enemy appears to have at least the same capability.

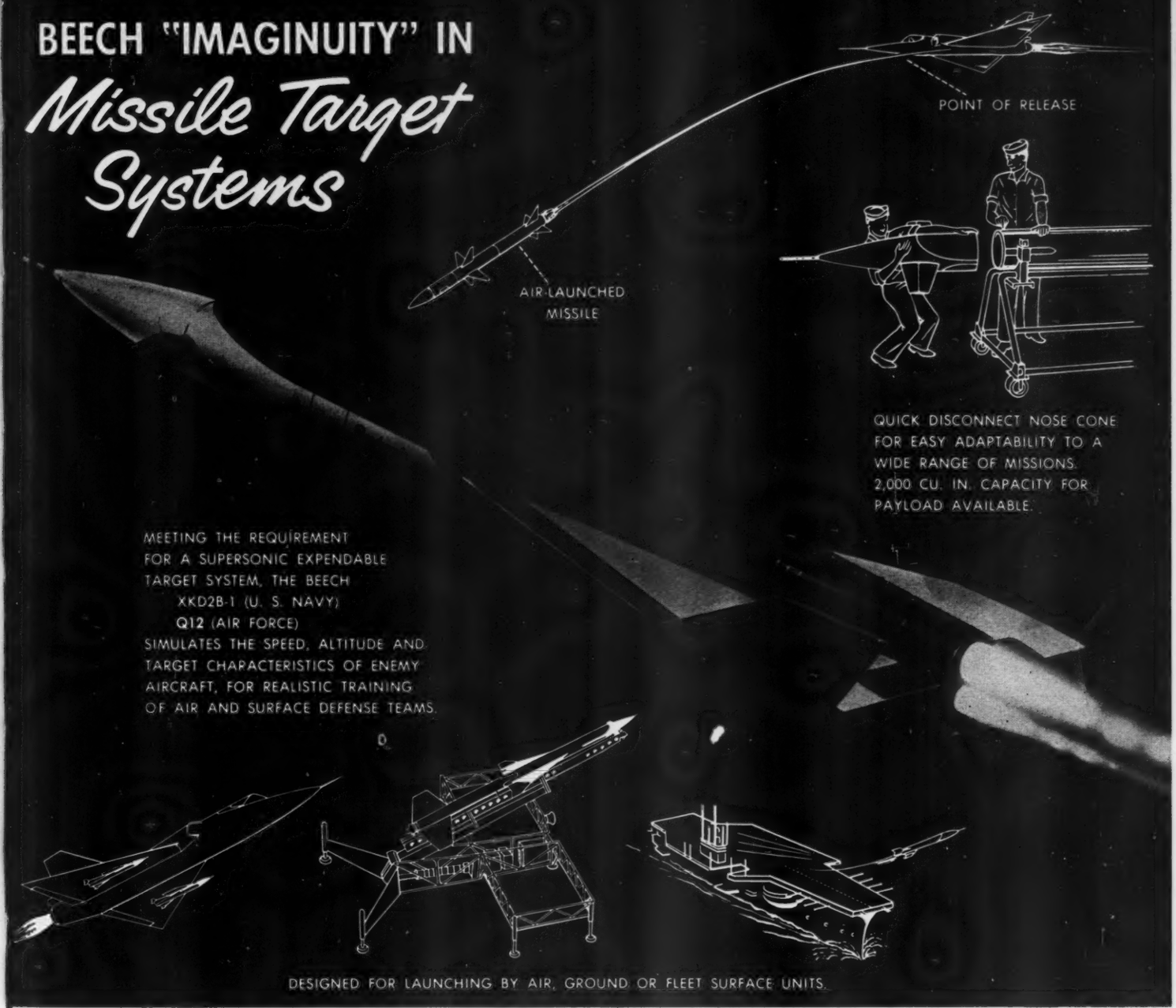
is for Nuclear, an ambivalent word used with Capability, Bomb, Club, Deterrent, Strategy, Retaliation, Devastation, and Age. Just as Nuclear Age excites images of untold wonders to come, so Nuclear (or Atomic) Retaliation stirs ugly visions of the death of the world. The amorality of any such weapon or strategy lends strength to arguments for long, conventional wars where rates of manpower attrition are more easily reconciled with other civilized values: 40,000 US highway mortalities per year, for instance. A nation so prolific and casual can easily support several times this rate for many years. The Communist Chinese also favor such a strategy, especially since they have not yet joined the Nuclear Club, and breed at a much greater rate than the Western World.



is for Organization, as in Government. The Defense Organization is a formalized grouping of civilians, sailors, soldiers, airmen, and marines. The vertical arrangement is by rank and salary; the horizontal distribution is by tradition.

(Continued on page 63)

BEECH "IMAGINUITY" IN *Missile Target Systems*


POINT OF RELEASE
AIR-LAUNCHED MISSILE
QUICK DISCONNECT NOSE CONE FOR EASY ADAPTABILITY TO A WIDE RANGE OF MISSIONS. 2,000 CU. IN. CAPACITY FOR PAYLOAD AVAILABLE.
MEETING THE REQUIREMENT FOR A SUPERSONIC EXPENDABLE TARGET SYSTEM, THE BEECH XKD2B-1 (U. S. NAVY) Q12 (AIR FORCE) SIMULATES THE SPEED, ALTITUDE AND TARGET CHARACTERISTICS OF ENEMY AIRCRAFT, FOR REALISTIC TRAINING OF AIR AND SURFACE DEFENSE TEAMS.
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Beech XKD2B-1/Q12: Winner of Navy/Air Force design competition . . .

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Designed to simulate the speed, altitude and target characteristics of enemy aircraft, the Beech XKD2B-1/Q12 makes possible effective testing of advanced weapons systems and provides realistic training—at low cost—of air, ground and fleet defense units. Into its development has gone more than 6 years of Beech experience in cryogenics, plus over 27 years of airframe know-how. With its pre-programmed guidance system, it operates at altitudes from 1,000 to 70,000 feet and at speeds up to Mach 2. Adaptable for use with Nike, Terrier and Talos launchers, the target system has promising potential for economical development as a missile system. It can carry a substantial payload, to fulfill a wide range of future missions.

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Visible near the top are the Joint Chiefs, a military forum concerned with diminishing traditional differences and at the same time ensuring that they are not diminished too far. The many civilians provide reinforcement in depth for the civilian Secretary, in the event the Chairman of the Joint Chiefs decides to overthrow the Government, and tries to do it through channels.

is for Peace, an uneasy condition of mutual distrust between nations which have conflicting goals and are not yet at War. When two nations have the capability to grievously maim each other with Atom bombs, Peace is a manifestation of stalemate, when the political ideology of one nation is dedicated to the destruction of the other, and has the necessary technology to back it up, Peace is not long for this world. Unless the more Peace-loving of the two is prepared for equal, or greater, technological exertions.

is for Quantity. The difference between unequal Quantities is a Gap. There may be Communications Gaps, Intelligence Gaps, and Missile Gaps. A Missile Gap results from one nation having three times as many Missiles as its opponent. When this Quantity is sufficient to destroy an opponent's offensive aerospace Forces, Bombers and Missiles both, the opponent may discover that it is too late to recalculate the risk in his position.

is for Response, as in Response to an Aggression. A nation which commits an aggression against another, or a coalition of nations pledged to a concept of mutual support, expects resistance. If the resistance develops too tardily, the aggression may already be accomplished, even though the victims may be collectively stronger than the aggressor. To prevent such a foolish possibility, Response should be immediate and of a character to clearly demonstrate to the aggressor the greater risk of total involvement and ultimate defeat. A flexible, or Blood and Sand, Response is one which enhances iron weapons and argues for a more equitable distribution of the Defense dollar. It presumes that the Korean Law of Sanctuaries will not be violated, even by an enemy *in extremis.*

is for Sanctuary, a supposedly inviolate haven from which a warring nation can project its military Forces into an arena elsewhere. As long as the respective Sanctuaries remain unmolested a War can continue until one side or the other: seeks armistice to consider future courses of action; admits defeat; uses nuclear weapons in an effort to reach quick decision. The greater the commitment of national Forces and resources in the area of conflict, the greater the likelihood of the war becoming Atomic and General if the Sanctuary is violated. If the Sanctuary is more essential to the military operations of one nation than the other, the greater the risk of attack upon it. Nations which become involved as Sanctuaries may be dubious of the distinction, unless the guest nation is unquestionably superior in its General War capability. Dry-land Sanctuaries are about as vulnerable as floating Sanctuaries.

is for Total, to describe a War of Maximum intensity between two nations or coalitions which are Totally exposed and Totally committed. In Total (or General) War, Atomic bombs will be used from the outset (by those nations which have such a capability), and the warring nations risk complete loss of control over their political futures. If the objective is simply to force a readjustment of conflicting national goals, this can be done by negotiation as soon as one nation achieves demonstrable military superiority over the other. There is a popular and somewhat fuzzy notion that incineration of the enemy's population will automatically terminate a Total War. In reality, it may only increase the tempo of the response, as the victim's remaining Atomic Forces react in fury.

is for Unification, a legal rearrangement of the armed services which was enacted in 1947, again in 1958, and about which

(Continued on following page)

legislation is perennially pending. Unification and Reorganization Acts are attempts to evoke a single defense strategy from the variety sponsored by the Services. Thus far, the Unified and Specified Commands are the principal concessions to such a sensible idea. The suggestion of a single Service, or Chief of Staff, to manage and operate today's Forces (which more and more demonstrate competing capabilities), or a functional grouping of like forces, is linked by critics to Totalitarianism. Whether an enemy is three times as much, or only one-third, Deterred by the present diversification is a secondary consideration.

is for Victory. Victory is the point in War at which the superior military Force is able to operate without hindrance from the other. Victory may only be a tacit acknowledgement that such a relationship exists, or hostilities may be formally terminated by armistice, negotiation, and surrender, with specified penalties and safeguards. Common sense rejects the inverted idea of achieving Victory with numerically inferior Forces, but for thriftiness, it has great appeal.

is for War. War may be called—for the convenience of the writer, usually—Public, Civil, Global, Small, Nuclear, Limited, Conventional, Hot, Unconventional, Brushfire, or World. "Cold" is a misnomer resulting from an indignant and belated US recognition of a fact of life: nations are always in conflict. When national objectives can be reached no other way—as by coercion—conflict may evolve into War. War is usually waged by previously trained Forces of one government combating the military Forces of the other. All kinds of weapons may be used to wage War, depending on the tempers and situations of the nations involved. War with Atom bombs is predicted to have two phases: a Decisive Phase (achievement of *significant* superiority by one Force over the other), and a Subsequent Phase (during which the significant superiority becomes indisputable and irreversible). When War finally results in a recognizable Victory for one government, it can forcibly bind the other to courses of action which will eradicate or suppress the original causes for conflict. A War which results in the total destruction of the loser not only permanently removes the source of tension, but relieves the Victor of the burden of reconstruction, since there will be nothing left worth repairing.

is for X-ray, a radiation phenomenon associated with Atom bombs. Because it, and other visible and invisible effects of an Atom bomb can affect great numbers of people in a very short space of time, Atom bomb subjects form the agenda of endless committees, groups, movements, conferences, and conventions. Since Missiles with Atomic warheads are not wholly accurate, and the long-term effects of an Atomic War are not easily predicted, there is some reason for all this discussion. Besides which, it is more difficult to see how General War could be fought without A-bombs, than with, so as a result discussions will in all likelihood continue for some time.

is for Yankee, a stereotype of the US citizen not much respected abroad for his restraint, benevolence, and sincerity. Introspective Yankee tourists are much puzzled by this attitude, but nevertheless pleased that goods and services overseas are so cheap.

is for Zero. Ground Zero is a geographic coordinate on the surface below an Atomic burst. Nothing can withstand present weapons at Ground Zero or for some distance from it; therefore it is almost impossible to shelter populations if they become targets. Fortunately, civilian populations contribute little to the national War effort during the Decisive Phase, so that the primary concern of government is to protect the people from Atomic by-products. The question of public shelters has been, is being, and will continue to be, debated. But debate is scant protection from fallout; thoughtful citizens will provide their own shelter.—END

Colonel Deems, the author of this primer for strategists, is assigned to the Office of the Assistant for Coordination, DCS/Plans & Programs, Hq. USAF. In World War II he served with Hq. Fifth Air Force and with the 6th Photo-Recce Group. After he attended the War College, he spent an additional four years at Maxwell AFB, the last two as Wing Chief and Deputy Commandant of the Command and Staff School. He has written on military gaming for the Air University Quarterly Review.

THE SPACE AGE IN PERSPECTIVE

SPACE DIGEST

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THE MILITARY MISSION IN SPACE—A Symposium 67

Deterrence Decades Hence

Lt. Gen. James H. Doolittle, USAF (Ret.) 68

Four Criteria for the Mission

Richard E. Horner 70

What We Need to Do the Job

George P. Sutton 74

The Space Arena

Dr. Edward Teller 78

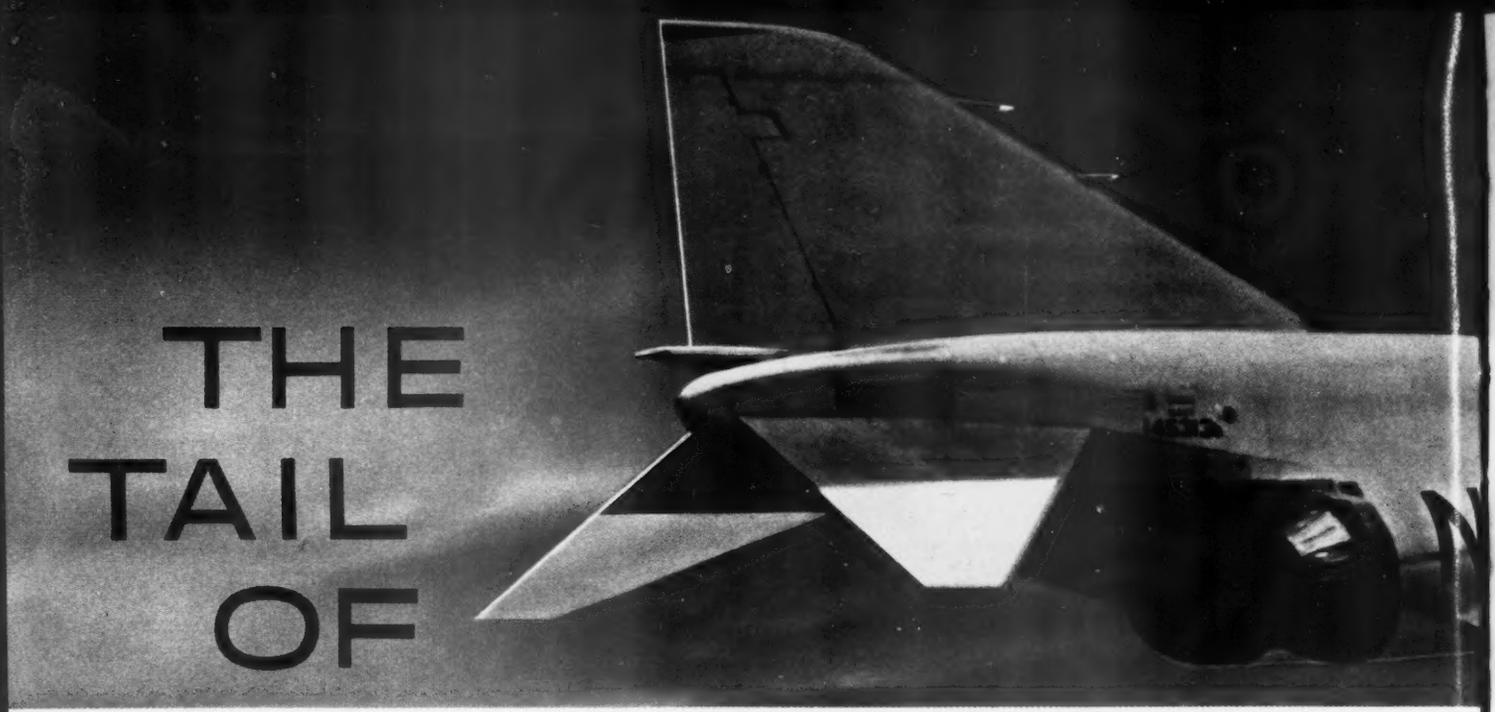
The Panelists Sum It Up 84

Space—Tomorrow's Battleground

Maj. Gen. Osmond J. Ritland, USAF 89

Speaking of Space

William Leavitt 94



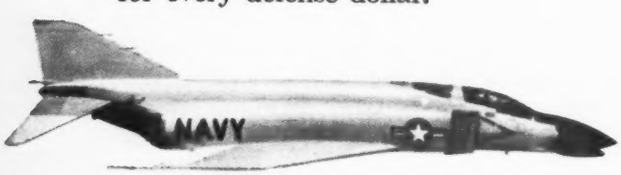
THE TAIL OF A PHANTOM

This is the tail of a unique aircraft—Phantom II. The horizontal surfaces are thin, swept, highly tapered and completely movable. The tail is an important example of highly advanced aerodynamic design.

The results of this advanced design are reflected in the excellence of the aircraft's stability and control characteristics. The large vertical fin, augmented by the drooped horizontal surfaces, insures rock-solid directional stability. Large tail area means sure control at maximum speeds and in the upper atmosphere.

The tail of the Phantom II has influenced and, in turn, been influenced by many other aspects of the aircraft's design. The negative dihedral is a unique answer to conflicting requirements. It is high enough to avoid the engine exhausts, and it is low enough to maintain proper aerodynamic relationship with the wing and to insure good stability throughout the speed range.

Altitude, speed and weapon-carrying capabilities have been combined in the Phantom II to a degree never before achieved in a combat aircraft. Now in production, the Phantom II offers flexible operational and armament capabilities for either police action or total war deterrence. The most versatile combat aircraft in existence—and the one with the highest performance—the Phantom II insures maximum defense for every defense dollar.



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THE MILITARY MISSION IN SPACE

The Military Mission in Space—an increasingly significant question as technological capabilities improve—was explored at a special symposium held at the Air Force Association Convention in San Francisco on September 24.

Participants were Lt. Gen. James H. Doolittle, USAF (Ret.), now Chairman of the Board of Space Technology Laboratories, Inc., moderator; Richard E. Horner, former Associate Administrator of the National Aeronautics and Space Administration and now Senior Vice President, Northrop Corp.; George P. Sutton, formerly Chief Scientist, Advanced Research Projects Agency, and now Manager, Development Planning, Rocketdyne Division, North American Aviation, Inc.; and Dr. Edward Teller, noted physicist and Professor at Large, the University of California at Berkeley.

The symposium, highlights of which follow, provided the first public and widely covered forum for discussion by experts of a vital topic which has thus far received only scant attention.

Because of its special application to the symposium topic, we also include significant excerpts from a presentation by Maj. Gen. Osmond J. Ritland, Commander of the Air Force Ballistic Missile Division, who elaborated on his views that ballistic missiles are but the beginning of a vast new extension of military capability into the space arena. General Ritland's remarks beginning on page 89, are excerpted from his presentation to the Industry Seminar, held September 23.

—THE EDITORS

"Certainly our principal deterrent will be in space . . ."

Deterrence Decades Hence

- Offense
- Defense
- Reconnaissance
- Navigation
- Meteorology
- Communications

LT. GEN. JAMES H. DOOLITTLE, USAF (RET.)

WE CANNOT deal with the military mission in space without considering: What is the military mission as a whole?

This is a question difficult to answer. I will try to answer it in a brief, oversimplified way and say that the military mission is, first, to deter war and, second, to support our national policy.

I know that there is much more to it than that, but again I think that basic answer serves to at least partially set the stage. We realize that the Soviets respect only strength; therefore, we must be and remain militarily strong.

We must have the strength to deter aggression. For the past decade the long-range bombers and nuclear weapons of the Strategic Air Command have been our principal deterrent and they have maintained the peace. For the next decade they and our long-range missiles again will be our principal deterrent.

Now, how about the more distant future after the next decade?

Certainly, our principal deterrent will be in space. I would like to mention some obvious space missions.

First, offensive systems, strategic systems to deter or deal with all-out war. First, missiles, next, Dyna-Soar, and next—it is hard to know exactly what, but certainly *something*. Even the tactical mission may have a place in space or, rather, space may have a place in the tactical mission—where we deter or deal with limited wars and certainly must have smaller and more selective weapons to do the job.

Second, defensive systems to minimize the enemy's offensive capability by protecting ourselves from it.

Third, reconnaissance systems.

Fourth, navigational systems.

Fifth, meteorological systems.

Sixth, communications systems.

The last three—navigation, meteorological, and communications systems—all have important civil applications. In fact, almost every device that is developed for military purposes has a direct or indirect civil application.

The communications satellite in particular will provide more reliable, more secure, and more economical global communications.

We hope that improved communications will help create better understanding between nations.

The Soviet objective is to communize and dominate the world. They have a long-range, consistent, and flexible plan, aimed at that objective. Certainly, we cannot deal only with all-out war. We must consider *other* methods of Soviet conflict and how they may be dealt with in space.

The question that people, particularly those of us who have been in the military, are most often asked is this:

What is the likelihood of an all-out nuclear conflict with the Soviets?

My opinion is that the likelihood is remote, provided we remain militarily strong. Should we become weak enough so that they felt that they could achieve their objective of world communization and world domination through a military coup without unacceptable damage to themselves, I think war would then become very likely.

In other words, military strength deters war. Weakness on our part would surely lead to all-out war, but it is not enough, as I said, to deter war.

Deterring all-out war is our first obligation, but we have additional obligations.

First, we must deal with local wars. We must deter them with mobility on land, sea, and air, with weapons that are small, powerful, and economical.

Next, we must prohibit infiltration and subversion.

Next, we must counter exploitation. The tendency of the Soviet is to foment discord, promote strife, and then fill the vacuum. Certainly, we must use propaganda that will help us woo the uncommitted nations and the weakly committed nations.

The Soviet Union is doing a good job of propaganda and they have chosen space as the arena in which to do so. Certainly, propaganda has serious military, political, and economic implications.

Next, we must face up to the technological conflict. We must have an adequate educational system, which I do not believe we presently have. We must improve or increase our stockpile of fundamental knowledge. We must do more basic research. We must excel in science if we are to lead in technology.

Last, the economic conflict. The Soviets are getting their house in order in order to win the economic conflict. They are developing their heavy industry, power, and communications.

I was in Russia last year and at Yalta I saw a sign which showed a Russian with a hammer and an American capitalist with a diamond in his navel. The caption was, "By 1965 the Soviet bloc will produce more than half of the total production of the world."

In other words, their objective, which I am sure they will not achieve, is for the Soviet bloc to produce within five years more than the rest of the world put together.

They are improving their standard of living, getting better housing, getting some consumer goods. You may recall that Khrushchev has stated that within ten years, by 1970, the Communist citizen will be the most contented citizen in the world.

This, I am satisfied they will not achieve. But we certainly have to see that they do not, and it will take a certain effort on our part.

They are entering world trade and they will be tough. They can break any market and they will certainly carry out the economic conflict to the end.

It may seem that I have gone far afield. I do not feel that I have, because I feel that it is not adequate in this day and age to deal simply with deterrent power. Our military power must be tied to our economic power, and all must be tied to our moral power and to our willingness to win and to work if we are properly to exploit the space potential.—END

One of America's leading airmen, General Doolittle has had distinguished careers in military and civil aviation. Holder of a doctorate of science from Massachusetts Institute of Technology, he is a member of the President's Science Advisory Committee, and board chairman of STL.

"We should not . . . be blindly making . . . investments without the best possible assessment of the likelihood that the end product can indeed be used."

Four Criteria for the Mission

- **Technical Feasibility**
- **Military Desirability**
- **Political Acceptability**
- **Economic Practicality**

RICHARD E. HORNER

THERE are prophets who optimistically foresee an almost unlimited exploitation of the newly available space environment for military purposes, while others are skeptical that even projects currently receiving development attention are worthy of the investments being made. To the extent that one is reliable in making subjective determinations, I would classify myself as being inclined to look on the rosy side of the technology of military space.

Yet, one can hardly be involved in space activities without being impressed by the lead times required for most significant accomplishments, and by the many other considerations that must be faced before significant accomplishments can be made.

For these reasons, in predicting realization dates for space systems I most frequently find myself about midway between the optimists and the pessimists.

In truth, there are few, if any, proposed activities in space that can be argued conclusively as being technically infeasible. There are, to be sure, some conceptual misunderstandings. These seem to occur when an effort is made to draw easily understood analogies between current requirements and capabilities and those which are foreseen in space.

There has been a temptation, for example, to envision plans for satellites engaged in dogfights and like activities, and to speak in terms of supremacy of space where one nation might deny space as a medium to another national interest.

Neither the physical laws of the universe nor the facts of international political reality would seem to support such circumstances. I do, however, have the utmost faith in the genius of our scientific and engineering community. Given the proper environment and the sources with which to work, physical, life, and social sciences can be manipulated to produce results which challenge the imagination of each of us.

The difficulty we usually encounter in our thinking results from an imperfect understanding of the mating between these three disciplines, and, sometimes, I am afraid a marked impatience and intolerance of each group of scientists for the input of the other two.

To illustrate this point, I would like to quote for you a statement that has been heard in my estimation too frequently in the past two or three years. This quotation goes something like this:

"If adequate resources were made available, we could land a man on the moon in 1965 or 1966 or 1967."

Well, there are at least two things wrong with such a statement. In the first place, the author makes it with the full understanding that he can never be proven wrong.

The second flaw in such a declaration is that it appears to represent the thinking of a limited segment of our society. The champion of the physical scientist, for example, might be expressing his absolute capability to accomplish the most difficult feat, if the economist, the administrator, or the politician would provide the resources and get out of the way.

There is nothing wrong with assessing the desires and capabilities of each group individually, but, on the other hand, we must not forget that there is an interaction, a dependency, between the elements as well. Little value, little financial value, stems from our castigation and belaboring of the politician, for example, simply because he is a practitioner of a very inexact science, whereas most of us would prefer more rigorous rules to live by. Perhaps a better procedure would be more cross-fertilization as represented by increased numbers of scientists participating in the management of our national structure.

One of the major problems in deciding on military activities to be prosecuted in space is to assess properly the combination of technical feasibility, military desirability, political acceptability, and economic practicality. Any one of these four qualities can, if seriously compromised, defeat the decision to undertake fruitful research and development. Together, they constitute an extremely complex set of conditions that vary in their relation to each other, and vary as well with time in an almost unpredictable fashion. I would like to suggest that it will be interesting to keep some of these qualities in mind as we consider their influence on our past, present, and future military activities in space.

Considering past practices and influences is sometimes a useful insight into the future, but here again, a word of qualification: I believe there is sometimes too much reliance placed upon the trends and rate of changes as recorded in history in making plans based on predictions.

An example, perhaps, is the most frequent practice in this respect to compare the growth of the airplane with the projected growth of spacecraft. In many ways, this can be a reliable comparison, and I am sure that valid points can be made in extrapolating the application of the physical sciences to the development of hardware.

Frequently, however, the comparisons are made in a more general sense, and it occurs to me that there are some pitfalls here. There might very well be some discontinuities which would tend to invalidate, for example, the frequent practice of prediction by application of ratios.

For example, it seems quite certain that the development of the airplane was greatly influenced by the inherent desire of mankind to extend the dominance of his will over the surface of the earth either by the means of personal travel or the use of the airplane in warfare.

It is not nearly as clear that the same motivation exists, or will ever exist, for mankind to seek such dominance over areas of the moon or other celestial bodies. We might as well face it—the real estate just isn't as attractive. Moves that are made in that direction will likely result from purely competitive consideration.

Making this point in a negative sense, it is possible to think of many examples of lack of progress simply because a driving motivation did not exist.

For example, it has not been unusual to hear of more progressive schemes for colonization of the moon than of Antarctica, and these schemers usually point out that lunar colonization will be perfectly feasible as spacecraft develop along a linear projection of the progress made in aircraft development.

Aside from the question of the transportation, though, shouldn't we recognize that we have had the capability of settling in Antarctica for some time, but that national motivations have been quite restrained in this respect? It has even been possible to reach international agreements for joint activity there, even though the environment is much less hostile than that on our moon where we seem to speak more strongly of national interests and competitive efforts.

But I would like to get back, if I may, to the application of the four tests that were suggested earlier—technical feasibility, military desirability, political acceptability, and economic practicality.

The prerequisite of establishing technical feasibility before undertaking large-scale effort in program implementation of any new device is well understood by each of us.

A similar situation prevails as regards military desirability. Here again there might be differences of opinion as to the relative military merit of individual systems, but the fact that any new development must fulfill a useful military purpose is rarely, if ever, challenged.

As we move into the area of economic practicality, we are certainly moving into a more hotly contested area. We each find ourselves asserting a specially qualified insight into the understanding of our national economy from time to time with our own analysis of the levels of expenditure which are permissible, essential, and even desirable.

I am sure that here again those who have been given the responsibility for making the important decisions for our government in these matters must find themselves in a situation where any decision they make agrees with only a very small minority of their critics.

But curiously enough, careful scrutiny will reveal that even in this contentious area the disagreement is only one of degree and not of principle. Almost everyone today would agree that it is impossible from a financial point of view to support all of the promising developments that have been suggested by burgeoning technology. So, to even the most progressive liberal, there is the necessary conditioning of selectivity, both in tasks and in timing.

In the last of the four necessary qualities that a military space development must possess, that is, political acceptability, we have an even more uncertain and debatable issue. It is again an area in which we each are inclined to express ourselves as experts on occasion, but it seems that these kinds of problems are the most difficult about which the issues can be clearly drawn and faced up to by the authorities.

For example, many of us will recall the heated debate which boiled around the question as to whether or not it would be acceptable to fly aircraft armed with nuclear weapons over our populated territory, that of our neighbors, and the high seas. I am sure that you, as I, had the impression that our military forces were well along in their design and force planning before a positive determination was reached in this matter.

In fact, it is difficult to discern to what extent such planning and development investment had an influence on the outcome of this decision.

And considering the difficulty in arriving at some of these international political decisions, perhaps they are best left for this type of an evolutionary determination rather than to seek a neat and clean resolution which would reassure the integrity of our development efforts.

We should not, however, be blindly making these investments without the best possible assessment of the likelihood that the end product can indeed be used. Such an assessment is not always easy to make. Most of us are aware, for instance, that in the case of the nuclear-powered airplane even the experts cannot agree as to what the relative hazards are of flying such an airplane from any given airport location. Obviously, the description of such hazards is prerequisite to a final determination as to whether such flights will be permitted.

In the application of space vehicles to military uses, there are many such determinations to be made. They arise primarily because of unique characteristics of military space applications. They will be frequently used during times other than a declared war, and their global nature exposes them to the interests of every nation on earth.

Up to this point it has been possible to almost completely avoid the issue of hardware falling from space onto the soil of other nations. Except in rare instances, it has been possible to plan trajectories such that upper-stage boosters fall in the oceans, and even overflight of the soil of other nationals has been avoided in most cases until orbital velocities have been attained. With no conscious effort, a principle has evolved which seems to hold blameless the sponsor of any device which goes into orbit and subsequently returns to earth in a random dispersion. Of course, this principle is yet to be thoroughly tested, but at least it has been convenient to avoid the question of liability until now. More difficult problems will arise in the future, however.

Then, too, there is perhaps as much need for development and progress in national attitudes as there is for ingenuity in the invention and use of space devices. A more widespread understanding of absolute risks and relative dangers will permit many activities which might seem politically unacceptable today.

Of the military space development programs that are currently under way, it can be said with confidence that they pass all the tests to the extent that it is necessary to justify the investments.

Of course, we would hardly expect the USSR to applaud enthusiastically our efforts in either earth surveillance or ballistic missile systems. But then, we wouldn't make that a test in the category of political acceptability, and it is generally agreed that space-based earth surveillance systems do enjoy a degree of political invulnerability.

In fact, this very characteristic makes them especially attractive in our effort to correct the asymmetry in our comparative intelligence positions and thus develop a mutual confidence essential to world peace, a unilateral implementation of the open skies policy, if you will.

Likewise, the development of early warning, probably as an adjunct to the peacetime surveillance system, as well as communications, meteorology, navigation, and geodetic measurement devices, all seem feasible and desirable from each of the four points of view we have used.

I have emphasized the word "development" in this statement. When it comes to establishing operational systems in each of these fields, the issue is not quite as clear. Obviously, the decision to develop would not have been taken unless there was some confidence that their useful operation would come to pass. The only point to be made is that the relative importance of the tests to be applied changes markedly.

The technical feasibility and political acceptability are established in the development period. Thus, for the operational systems, the relative military utility and the economics of the situation become of overriding importance. As the military desirability increases, the cost that can be afforded also goes up.

However, there are definite limits as to what can be afforded in the total scheme of things, and cost reduction in military space systems must, and I can say *is* receiving a great deal of attention in recent months in anticipation of the needs of operational systems.

Engineering for economy, improved reliability, booster recovery, and reuse are a few of many promising areas receiving attention. Some progress has been made, but the surface has barely been scratched if practical operational systems are to reach the utility that is usually predicted for them.

Many of the most ardent space technology advocates have spent time devising long lists of possible military activities in space. One sometimes gets the impression from these efforts that there is some concern that there might not be enough opportunity to exploit this new medium. Such concern certainly would have no foundation in view of the very imposing tasks yet to be accomplished in perfecting the systems which are so attractive as to be accepted without question as military necessities. There can be little doubt that years of work remain before we will be completely satisfied with any of the systems now under development. In fact, they are of such a nature that improvements will always lie before us.

There is one additional area of work which is only beginning to receive active attention, and it seems to possess the same qualities affecting attainability that we have been discussing. This is the general area of space vehicle interception or rendezvous.

To be sure, the techniques required are not quite as well in hand, and ultimately affording the cost of frequent usage is even more obscure. But there are so many potential uses in terms of servicing of spacecraft, their inspection, transfer of astronauts and others that it certainly seems worthwhile to support a vigorous development and demonstration effort.

It seems likely that many of the more advanced proposals for military space activity, such as space-based offensive and defensive weapons and military excursions into deeper space, will have to await further development progress.

The realization of technical objectives in the current programs, and especially the cost reduction objectives; the satisfaction of certain geopolitical questions concerning the placing of weapons in space; and the advancement of the nation's program in space exploration all seem to be prerequisite to the more ambitious schemes.

Each of these prerequisites indicates necessary attention, and as in every other endeavor, success breeds further requirements, and the technology of this nation advances accordingly. I personally believe very strongly that the technology which flows from this space program may, in fact, be the most important product of the program.

This can work peculiarly to the advantage of the United States, as it differs from the past decade of technical progress in military technology, where many nations of the world participated. There are really only two major nations undertaking large efforts in the space program. Our other single competitor is just not as prepared to absorb into his society all of the sophisticated development products of the space program.—END

An aeronautical engineer with a distinguished military record, Richard E. Horner has served as Assistant Secretary of the Air Force for Research and Development, and was Associate Administrator of the National Aeronautics and Space Administration prior to joining the Northrop Corp.

"... until we understand how to use the space environment effectively for either offense or defense. I believe the military space mission will remain a relatively minor one, in terms of our deterrent capability."

What We Need to Do the Job

- **More Space Environmental Data**
- **Added Component Reliability**
- **Maximum Project Selectivity**

GEORGE P. SUTTON

AS noted in the National Aeronautics and Space Act of 1958, the role of the Department of Defense and, therefore, also the Air Force, is limited in space to the development of weapon systems for military operations related to the defense of the United States, including the research and development necessary to make effective provisions for these items.

In consonance with this particular policy, the primary interest of the military is, I think, the application of new capabilities for flight in space as a means for better achieving the old classical military missions, and for achieving a good military posture for the United States and its allies, rather than spaceflight or scientific exploration of space as ends in themselves.

Military space efforts today are an integral part of our over-all military program and certainly are going to complement our other military capabilities.

Thus, considering the nature of these space objectives, it is not logical to form a long-range military space program per se separate and distinct from our over-all Department of Defense military program. Therefore, the Department of Defense, at the present time, does not have a single agency or a single group concerned with the execution or the formulation of an over-all military space program.

On the contrary, the organization of our space programs has been broken up to align them with our other military projects. For example, the Advent communication satellite system is going to be one form of very effective, efficient worldwide all-weather instantaneous communications.

But there are many other types of military communications such as those using cables, radio links of various types, high-frequency scattering systems, and many others. In the organization of the Office of the Director of Research and Engineering, for example, all communications projects are handled by the same group of people, but the Advent project is the only space-related communications project that this particular office has

responsibility for. The Army and Navy and the Air Force have different, yet distinct, responsibilities in space-related projects in those areas where the use of space is best suited to their particular capability.

Thus there is no single military technical focal point for space development or space research today. Even in the Air Force the space-oriented projects are not vested in any one single command or development division.

By law, the scientific research in space is the function of NASA. The Department of Defense in the past has enthusiastically supported NASA in this endeavor and looked to NASA for many of the results of this work.

The coordination of work within the Department of Defense and with NASA, I think, on the average, is good, and the work done is better than average.

The present concept of the extent of military space is somewhat limited. There just is not, at this time, a clear understanding of a good military usefulness for deep space missions, and for planetary missions.

Perhaps, as we learn more about it, we will understand some of them; but today our vision in these areas is somewhat limited.

Let me briefly go over some of the military system developments that are in categories which use space as the operating environment, where we use space in the solution of practical military problems.

It is difficult to see in the offensive area at this time how we are going to use the space environment effectively and efficiently to do the offensive job better than with other means of delivering a strong blow. But there are various studies being done, I am glad to say, in these areas. How we do the job is not quite clear at this time.

The same sort of comments apply to use of the space environment for defense. In both of these areas we need some research and some component development and studies, and some of these are on the way, in order to precipitate a decision which will define at an early date the work that needs to be done in the future. This work, I am sure, will be done expeditiously.

As a part of these defensive systems, the Air Force is currently working on the Midas project, which promises to become a very useful early-warning system. It is directed toward the development of a capability for providing continuous screening of worldwide launchings of ballistic missiles through the detection of infrared emissions from the rocket exhaust.

The observed signals then are reported by the satellite to ground stations which, in turn, relay the data to appropriate data centers and to the operational forces. In this manner maximum warning can be obtained of impending missile attack. The problem of intercepting and inspecting unfriendly satellites could also perhaps be classed into this category of defense.

The next category in my listing I call the "Support Category." It includes such systems as weather satellites, which are currently being developed by NASA, but which eventually will have some very real military significance.

This includes communication satellites and navigation satellites. The navigation satellite system is perhaps the system that will first become operational. It is a simple one and it is aimed at providing very quick all-weather global data.

The next category I call "Logistic Systems." They are not very clearly defined at this particular time, but they could include such devices as manned maintenance and servicing at some time in the future.

My last category I would like to call "Test Vehicles," and into this fall such things as the modified Scout vehicles which we use for exploring various basic phenomena and for the testing of many subsystems.

It also includes today the Dyna-Soar I vehicle which is an aerospace exploratory development, aimed to explore controlled flight spectra up to very high speeds and up to fairly respectable altitudes.

It furthermore includes the Discoverer project, whose purpose has been the development and testing of various techniques and components which can be used for other military systems.

It is interesting to note that, at this time, none of these systems are really approved for production or complete weapon system operation. Several are in the development and several more are in the study or research stage. This is a rather typical indication of our being relative novices.

How do we utilize these space systems in military missions?

Wars, classically, have been fought by having either a good offensive capability and a good defensive capability. While we do need the support systems and some of the test vehicle systems that I have previously mentioned—and this includes such things as communications, navigation, reconnaissance—they by themselves cannot be decisive.

The military space vehicles which are being developed today are primarily those of the support

and test-vehicle type. We still need to rely on more conventional means for offensive deterrents and defense.

Until we can more clearly understand how we use the space environment for offense and defense, the military space system program, I believe, will not receive the emphasis or the priority attention that is now being enjoyed by systems which make up our principal deterrent capability.

I do not wish to imply that the support systems are insignificant or unimportant, for we must have them in order to cope with the many complex strategic and tactical situations that can arise in a conflict. They greatly augment our offensive and defensive capability and they are necessary; but, by themselves, the support systems will never eliminate a single enemy.

In addition to these space systems which I have discussed, there will likely be a number of others that we will see more clearly as we understand more about operational and environmental problems in space.

Present space systems require very reliable vehicles and payloads which will stay and function in orbit for a reasonably long period of time. It is an expensive process to replace a payload that is not working. It is no secret that it costs somewhere between $5 and $7.5 million per launch to put a major payload in orbit. If we could materially reduce the cost of these launchings, then the military use of space would look a lot more attractive because many of the systems that we visualize require a fairly good number of vehicles.

A great deal of attention needs to be and is being given to this problem. In addition to the various categories of space systems that I have already mentioned, it is necessary to push the state of the art in the fields of components and other techniques related to space. This might make future space systems much more desirable.

Examples of these are auxiliary power devices, various advanced propulsion systems, various ground-based equipment for satellite surveillance, tracking, and satellite control, plus investigation of the space environments.

Let me speculate just very briefly about the programs of the Soviets in space:

For communications purposes, the USSR is located with its allies on the same piece of land. Therefore, they do not have a real need to communicate, as we do, with far-flung bases in various parts of the world. Limited communications means by wire and radio are much more adequate for them, and they do not really have as urgent a need as we do for a communications satellite.

Since we do not make any secret about the location of our military bases, our arsenals, and our airports, I do not see that they really have any need for surveillance satellites.

Perhaps they do have a need for an early-warning satellite or a satellite inspection system, but their need may not be as great.

There is also evidence that they have launched relatively few satellites compared to the fairly large number that have been launched by us.

So I am led to believe that the military space technology office in the USSR is very much smaller than ours. In fact, it is conceivable that their military satellite program is only a very minor one and their emphasis thus can be on scientific exploration and what I like to call the psychological-political effects of new space achievements.

Let me say just a few words about our general problems in the space field:

The question always arises as to whether the relative effort that we are now putting on space projects is sufficient at this particular time. We spent last fiscal year something more than $1 billion in this particular area. In this fiscal year the government is spending something like $1.5 billion of its 1961 fiscal federal expenditures on space projects.

Now, that is about two percent of our total federal budget. Not quite $1 billion of this is being spent by NASA, and a little more than half that is being spent by the Department of Defense.

This in itself is considerably more money than your government spends on running, say, the Department of Commerce, on aid to education, and on all medical research, private and government supported. The military part of this expenditure is a little more than one percent of the total military budget this year.

With the current pace of development and the goals that have been set thus far, this amount of money seems to be pretty close to being sufficient. If we decide to change our goals, to accelerate the programs, then I am sure that additional money would be required and required soon.

In the deliberations that must go on to determine the equitable distribution of the defense budget, there are many items that are more important to the defense planners and have more priority than today's space-related military systems. It is, therefore, very unlikely to me that substantially more money will become available for space projects, particularly since they are not

now currently useful for either offense or defense.

I believe firmly—that there will be a gradual increase and an orderly increase in the budget available for space projects, both at NASA and in the Department of Defense, but I do not personally expect a radical increase in these funds in the near future.

Thus, if we wish to improve our military space technology capability, we must look to other ways than merely increasing the budget.

Now, one way of increasing our effort is to select our projects carefully and properly, particularly where expensive systems are involved.

It is necessary to select the very best projects from very good ones, and to take a calculated risk that further development will not make the chosen project obsolete in very short order. There is no question that we are all taking a rather calculated risk when we bet that one particular weapon system would be better than another.

Many of the projects in the military space area that have been started will require a larger expenditure next year because of their normal growth in the development cycle. Therefore, although our over-all space expenditures will probably increase, there probably will be very little money available for starting major new projects, until some of our present ones give us further operating experience.

The problem of selecting the very best projects from the not-so-excellent ones is certainly not easy. It takes a great deal of study, a great deal of promotion, exploratory research, and investigations, to put a weapon system into development, much more than it took several years ago.

We just do not look at a concept and decide to go all out for it and put it into operation, go into troop training, logistics support, or supply training unless we are pretty sure that we are betting on the right course.

Another way to improve our military systems is to improve component reliability. If you make a mathematical reliability determination today, you will find that space-system lifetimes are relatively short and that you have to replace satellites at a very rapid pace.

I would like to suggest an additional method for improving reliability. It is not a new one.

As I have stated before, it is devilishly expensive to build and check out and launch a major satellite. Also we have been talking in the military procurement circles for a long time about an orderly system of incentive awards for good performance, for cost cutting, and for scheduled delivery.

If I could illustrate my point by a very crude—and perhaps very much oversimplified—example, it might work this way:

The people who are responsible for a successful launch and operation of the payload might be eligible, say, for an additional incentive of a million dollars which is still only a fraction of the total cost of the launching. I believe that such a system should soon show some rather interesting and spectacular results, compared to the paper work that is now necessary to fulfill the reliability requirements of many of the military services.

Many have complained that we are severely handicapped by a capitalist system in reaching quick, rapid, and effective action. Here is a tool of capitalism, incentive, that we could put to good work and hope that it would give us considerably better satellite life.

We do need a deterrent and we need a continued arsenal of deterrents that are capable of dealing a devastating blow to any attacker. It is not very clear at this time to me how we use the space environment efficiently to do this kind of a job.

The second major job that I have mentioned is the defense mission. Perhaps, at some future date, we can seriously consider a space-based defensive system, but we need to learn a lot more about it before we can be ready to permit major funding here.

Now, until we understand how to use the space environment effectively for either offense or defense, I believe the military space mission will remain a relatively minor one, in terms of our deterrent capability.

Even if we decided today to pick a concept for, say, a space-based defense system, it would take many years before it really would be effective in protecting us. The best approach that I see here is to learn more about our space environment and our military space operation. We can learn this from the satellite systems that are being developed now, and we can learn this from test vehicles and from additional work that we can do on the ground.

This is where I believe we need to concentrate our effort in the next few years.—END

One of the country's original post-World War II nucleus of rocket engineers, George P. Sutton, prior to his present executive post with the Rocketdyne Division of North American Aviation, Inc., was Chief Scientist of the Advanced Research Projects Agency of the Department of Defense.

". . . I would put first among all other military missions one—and that is to survive."

THE SPACE ARENA:

New Dimension for Prestige and Power

DR. EDWARD TELLER

THERE are a few things which to my mind seem to be exceedingly important, and I should like to concentrate on these.

For more than 100 years the United States has lived in safety, in complete safety. Nobody could have dreamed seriously of attacking us, much less of defeating us and terminating our national existence in a short and dreadful war.

Now, this has become a real and immediate possibility in the last decade. To my mind, this is the enormous military challenge which we are facing today. The weapons that have brought about this change are the ballistic missiles.

The ballistic missiles are often not counted as part of the space mission; actually, ballistic missiles, the technology, the instrumentation, more than anything else—the motive power—are so closely related to the space mission that I think it would be obviously misleading to discuss the two separately. The inexorable progress of science and the shrinking of our globe have wiped out the safety of our ocean barriers. The long tradition of this safety and the unavoidable development of a comfortable feeling that we are invulnerable, have delayed proper defensive measures. We have not undertaken sufficiently strong and vigorous measures, to make it as sure as possible in this dangerous age, that we will perform the first military mission. I agree to everything that has been said, but I would put first among all other military missions one—and that is to survive.

Now, I would like to be specific about this immense challenge. I believe that we never should —and I believe that we never will—take the immoral and the insane expedient of striking a first preventive blow. If we had definite information that the Russians would strike us tomorrow, it is my opinion that even under those conditions we must not strike first.

It is wrong, it is immoral, and, in my opinion, it is impractical. This means one simple, clear-cut but difficult, conclusion: We must be prepared to absorb the first blow and then to strike back. We must have a second striking force, and this second striking force is the kind of offensive capability which is the best defense in the world.

If the Russians know they may hurt us very badly, but that they cannot escape a similar or bigger blow upon themselves, this is the surest way to make certain that peace will be maintained.

This is not easy. Rockets are big, are expensive, are not easy and cheap either to hide or to make hard so that they will withstand an enemy blow. It is not cheap and easy to move them around sufficiently rapidly so that the enemy does not know where to strike. All these things are expensive.

We could make them much cheaper—and we are not making them cheaper. We could make them cheaper by continued experimentation with nuclear explosives. By this means, we could greatly reduce the weight of the payload of our rockets which carry nuclear warheads. Reducing the payload would mean that we have smaller rockets, smaller bases, a cheaper way to hide

our missiles, much greater mobility, and a much greater certainty that we can hit back.

The fact that we have stopped nuclear experimentation, that we have not resumed this nuclear experimentation is, in my opinion, not taking a calculated risk—it is taking a miscalculated risk.

This means a miscalculation that amounts to many, many billions of dollars, and it means more: It means that when we ought to be ready, we may not be ready, and it may mean more than billions of dollars—it may mean our lives, and it may mean the annihilation of our society and our ideas of freedom, of peace, of tolerance and, perhaps, of human dignity.

I would like to remind you that when we talk about the fact that we have not continued our development, we do not have any assurance that the Russians have stopped their nuclear experimentation likewise. They say they have—and maybe they have—I am not debating it. I only put before you one undebatable and technical fact that, had they wanted to violate their self-imposed test ban, we would today not have any technical means and we do not have any technical means to check whether they have stopped testing or not.

This much about offense.

Now, let me talk about a more popular subject, about defense. The Russians are offensive. So, of course, we should be defensive. What is better than to construct an anti-ICBM to shoot down anything that is hurled against us—and this is what most of us would like to do.

Now, there is one little flaw with this program. As far as I can see, it cannot be done.

I have made many mistakes in my life when I made predictions. But most mistakes I have committed when I said something could not be done.

If you work very hard you can shoot down an enemy missile, even though it goes much faster than a bullet under normal circumstances.

It can be done, but whatever we try to do to shoot the ICBMs down will be exceedingly expensive. On the other hand, the means that the enemy has to foil our defensive systems are much cheaper.

There is one thing that is harder to do than anything else I know, and that is to win a game of chess against an approximately equal opponent when you have given him the advantage of a queen. By telling the Russians, "You be the aggressors, and we will shoot down your bullets," we have given them that advantage.

I do not know whether I am right. I think I am right. I am not against looking at the problem of the anti-ICBM. By sad experience, we have all learned that whenever the Air Force looks, it costs millions of dollars which should be spent.

But I should restrict it to these economic *millions* of dollars and, as long as we have no better hopes than we have today, let us not spend the billions of dollars on doing more than looking. Let us not lull ourselves into a false sense of security that we do have a defensive system.

Now, having discussed the ICBM and the anti-ICBM, let us return to space.

We have sent up satellites which can observe. The Russians have an Iron Curtain. We cannot have an Iron Curtain and we cannot have a really effective secrecy because we are a democratic and open society. In such a world it is extremely important to be able to do justified observation which will ensure peace.

We have made big strides in that direction and they are worthwhile strides. We have sent up a weather satellite. We have accomplished the first really synoptic observation of weather. We have looked down on the ground from the angel's point of view, and have seen the big storms brewing among the clear areas. Today we have a real hope to get enough data so that we can predict the weather and, perhaps at some future date, we might influence even the climate.

We also have sent up a rather small and light package containing tough sheets which expanded into the ten-story balloon. It was the most spectacular of all our satellites, the Echo. It was very ingenuous and it served a very good purpose—communication.

All these things—communications, observation, weather—are of the utmost importance and, therefore, the control of space may become exceedingly important indeed.

It just might happen that the Russians will say, quite unjustifiably: "Nobody is going to look into our installations and nobody will report on our weather, and if you try to do that we will shoot your satellites down. We can do it." And they will do it. I hope that perhaps they will not, but they might.

The question is, if they want to control space, if they want to initiate space warfare which would not cost any lives down here on earth which might not be so unpopular, could they dominate space?

For the purposes of observation, communication and weather satellites are exceedingly important. The Russian could gain an incredible propaganda advantage, and on top of it, a military advantage, which might be decisive.

It might be decisive in local warfare, where weather predictions are important; it might be decisive in all-out warfare, where surprise is important.

There was a time when the oceans were as remote as space is today. The control of the oceans had a lot to do with power in this world. The nation which could build the heaviest ships, carry the most propulsive power, and the most firepower, was ahead of its competitors.

We can argue about the space race in many ways, but there has been no argument so far about one point: In carrying capacity the Russians today —and for the next few years—can outbuild us. As long as this is the case, there is no reason for complacency or economy.

Now, I would like to go to really distant places like the moon, like Venus, or Mars. What can we bring back from them? Can we gain there something of military value?

You have heard the statement—we can gain nothing. This statement I cannot contradict as much as I would like to do so; however, I would like to specify a little—what kind of nothing?

We have not colonized Antarctica. But I believe that life in Antarctica will appear like paradise, as compared to life on Mars or Venus or the moon. I would not go to those places for comfort, but the very discomfort that you find there is a challenge.

It is challenging because, in those places, you can get a priceless commodity—information, scientific information.

Is there life or something like life in these places? And what kind of life?

The absence of the atmosphere of the moon might give you a possibility of constructing on the moon scientific apparatus, observatories, laboratories, of the kind that we cannot construct here. We need air to breathe, but for the pure scientist, vacuum is a wonderful medium. We are spending here on earth millions of dollars in making a relatively pure vacuum in a relatively small amount of space.

Whenever you go to a strange place as Columbus did, you may find, and you usually do find, things which are worth finding even though all of us, including certainly myself, are much too stupid to predict what these things will be.

But what is the military value of all of this? Nothing. But again, I will tell you what kind of nothing:

When the Russians hit the moon, they celebrated a propaganda victory. When they took pictures of the back side of the moon, they had advanced greatly—and rightly—in the estimation of everybody.

Now, we have stated, and I am happy to say, rightly stated, that we have with our relatively minor lifting power made more important discoveries in space than the Russians—much more. I shall mention but two:

We have discovered the intense radiation belts around the earth which have been unsuspected which teach us a lot about cosmic rays and particles coming from the sun. These radiation belts may even become of practical significance for space travel.

And, as I have already mentioned, we sent up the first workable weather satellite, bringing back a great wealth of information for the rapidly developing science of meteorology.

All this we could do because, while the Russians have the greater weight-lifting capacity, we claim to have the better, smaller, more minute instruments. This may be indeed so, or else it may be that the Russian's instruments or instrumentations are better, but they do not care to tell what they found.

In any case the advance of science will disclose great possibilities and great vistas, which will catch the imagination of the people of the world. What is perhaps more important, our own children and our own students will be stimulated to participate in this great adventure—space.

I would like to conclude by one appeal to you, and it has been implicit in what I have said:

It is a mistake, when you are on the threshold of a new field, to subdivide—this is mine and that is yours. That is the business of the civilians and this is the business of the military. In a new field we do not know what we will find. Nobody has imagination enough to project the future.

Let us go ahead with all feasible, interesting, and important parts of science—and particularly the science of space—because in space there lies a great contribution to the future of mankind and to our own safety.—END

Noted nuclear physicist and Professor at Large at the University of California, Edward Teller has made significant contributions to American deterrent power, particularly in thermonuclear weaponry. A naturalized American citizen, Dr. Teller is a native of Hungary, where he was born in 1908.

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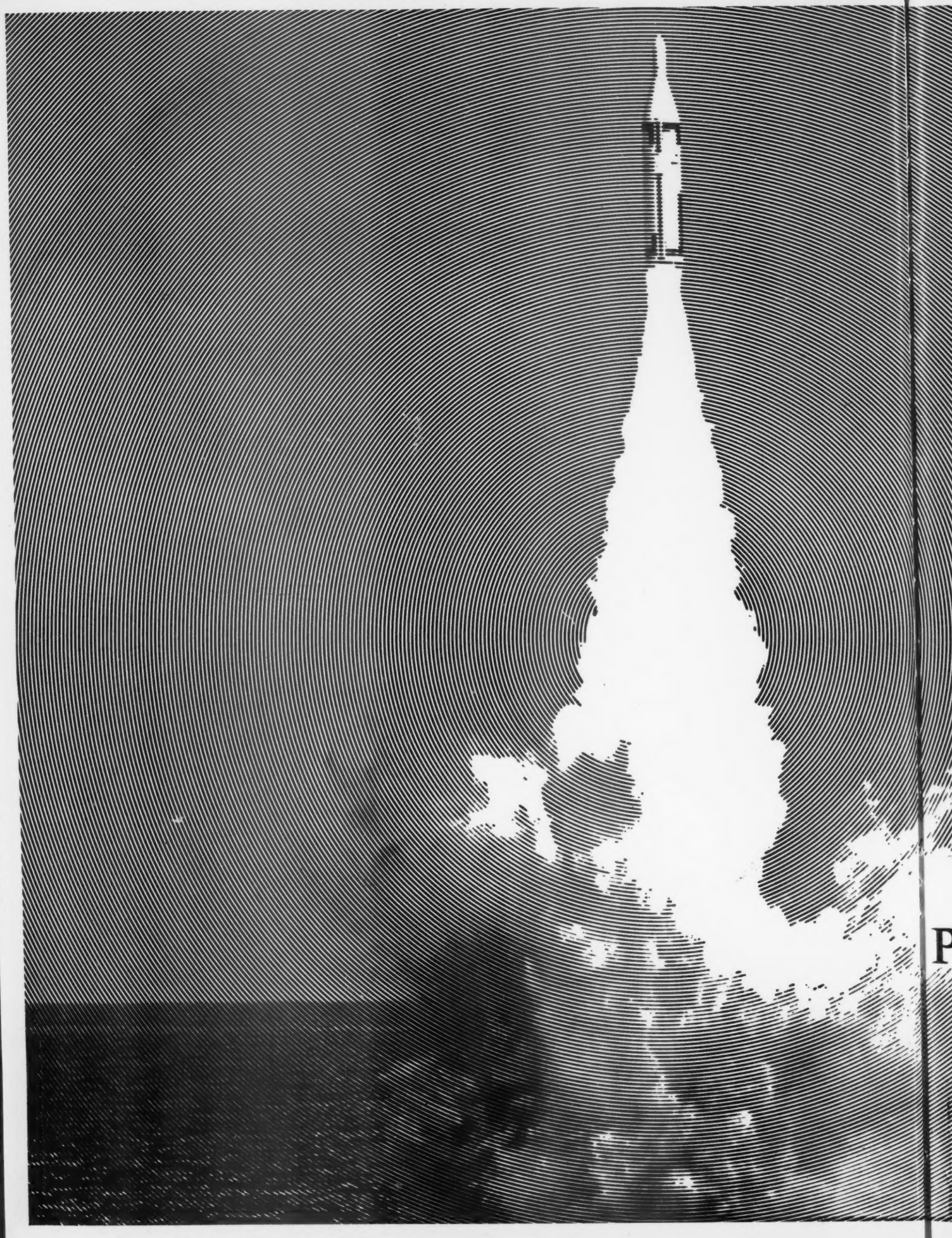

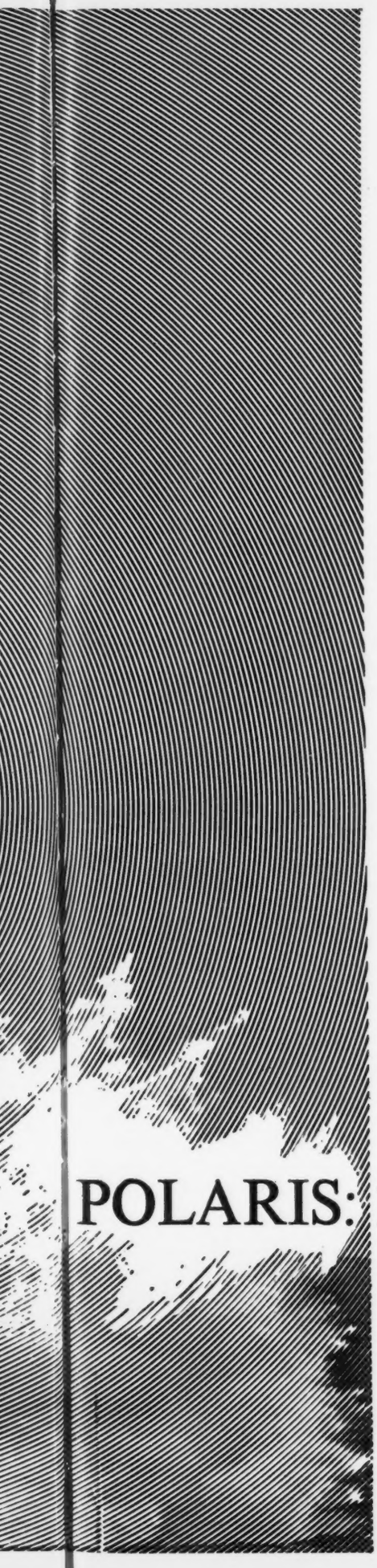

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THE PANELISTS SUM IT UP

Horner: Can space be dominated?

I find really very little to disagree with in the statements of my associates on the panel. I do have one or two minor points, however, which I would like to clear up.

First, perhaps a little bit of self-justification. I would like to make very clear one point, because Professor Teller made a reference to an example I had used—"colonization of Antarctica"—and I certainly do agree with him that the scientific exploration of the moon is extremely important.

As a matter of fact, I spent a very large fraction of the last fourteen months of my life engaged in implementation, ultimate implementation of that exploration, and I also agree with him that what comes from it we certainly are not wise enough to know today.

One remark of Mr. Sutton I would like to take mild exception to. I think his statement downgrades a little too much, for my comfort, the importance of the supporting systems, as he defines them.

It is very difficult to rank, in relative importance, the efforts that are going on in individual projects, but one statement was made in reference to the reconnaissance developments, that they never eliminate a single enemy.

Perhaps this is true; certainly it is true if you consider it from the point of view of reducing it to the components.

The hope, however, may be that it could create a circumstance in the world where there are some reductions in tensions, or at least in terms of making us better capable of eliminating any more rambunctious enemies.

A similar comment concerning Professor Teller's remarks. I certainly agree with his statement concerning the development of ballistic missile defense. I want to agree with him specifically now because I want to turn it against him a little bit in his discussion of the domination of space.

It occurs to me that perhaps the domination of space has many of the same characteristics, many of the same difficulties, as are involved in ballistic missile defense, with perhaps one or two additional degrees of freedom.

It may, indeed, be so expensive to deny individual access to space, in that it is much cheaper to put up the targets than to take them out.

I have just one question which, I hope, Professor Teller will clear up for me:

I again would certainly agree with his statement and rationale for the need of a second strike force. He went directly to the discussion of the pros and cons of the test moratorium which I am certainly not qualified to comment upon, but the thread

which joined those two thoughts together seemed to me to be on the basis of improved economics. I am simply asking: Is this justified wholly on the basis of being able to produce more offensive weapon systems to become targets?

I can understand such justification, but I wonder if also he had in mind some other suggestions. I have heard of the use of space for weapons testing and, of course, another question which he has dealt with, the question of putting a second strike force into space.

Sutton: Seven limitations

One of the problems that I think was alluded to by both the other speakers was: What are some of the technical problems that prevent us from going into space in a massive, rapid, quick, immediate way?

As I see it, there are seven technical limitations, perhaps, that limit us from using space as a military system effectively in the near future, and some of them have been mentioned.

We still do not quite know enough about the space environment. From a military point of view we have never really operated a system in space; we have just sent a few vehicles out in an exploratory manner. But the real problems, I think, in weapon systems today are generally those of data analysis, data transmission, decision-making, servicing, launching. And these problems we have never operationally faced as yet. There are many technical problems involved.

Then there is the problem of making the boosters cheaper and simpler, and one way that has been suggested is to try and attempt a recovery and to simplify the systems as much as we can.

Reliability is another problem that has been mentioned, but there are three others.

One is research on good power supplies. For military exploration we seem to need a lot more power than we need for just making a few scientific experiments, where a little wattage will do for quite a while.

The next area is that of manufacturing. We need to find a better way than we can think of now to permit a military vehicle to go from one orbit into another or to change its face in orbit, if you please.

Finally, we need to learn a lot more about the recovering of payloads. We made some great strides, but we still have a long way to go.

I would like to ask Edward Teller if he would care to make any promise about any use of nuclear power for propulsive purposes in space, because I know that he has looked into this particular area at one time or another in some detail.

Edward Teller mentioned the problem of the division between military, civilian, and commercial space interests. We are now so organized that we have NASA, and we have the Department of Defense, each pursuing somewhat separate but closely related programs. There is not really a major program in either one of the sides of the houses that the other side does not have a strong interest in.

I believe that we are doing reasonably well, inasmuch as the relations are good.

The Air Force has had the foresight to cooperate wholeheartedly with NASA, for example, and a good many people working in NASA happen to wear a blue uniform. So I feel that, while we may not be organized as a single agency in the government today, the cooperation and the interchange and the interplay are better than average.

Teller: A Better World or Worse?

Let me start by summing up, as far as space is concerned. I think you have discerned a trend of agreement between all speakers—we are for space.

Also, it was said that we must be a little careful and distinguish the worthwhile from the not so worthwhile objectives.

Now, let me come to some of the little things to be cleaned up—domination of space. Is it impossibly expensive to maintain the freedom of space?

I do not know. Maybe it is. When you look up at a huge mountain you lose your good measure, and you do not know whether it is really out of your reach or whether, with some hard hiking, you might get to the top of it.

Because the satellites will be our eyes and our ears, because of many other reasons, freedom of space is extremely important. We do not want to deny space for the Russians, but we want to be sure that they do not deny the space to us. I admit that domination of space might be impossible, but I think that it is a very much easier job than establishing an anti-ICBM as a defensive measure.

Consider this picture: An attack of a thousand missiles have been fired against us in the matter of not many minutes. Together with these missiles, there comes a great number of decoys, a whole junkyard, and a great amount of noise-making instruments based on the latest principles of electronic countermeasures

Now, your anti-ICBMs must automatically, without trial and error, pick out all the important

Is the "S" curve our best missile defense?

There have been many theories advanced on techniques of ICBM intercept, including those that postulate the use of an anti-missile missile. Some studies favor a head-on course for the weapon during terminal phase because any angle other than 180° from warhead flight allows too much error-margin, and 360° allows too much time lag for the "chase."

■ To give the anti-missile as much time as possible to seek the warhead, and lower the maneuverability requirements, it should be in the air ready to intercept while computers translate the acquisition signals into a plotted line of approach. Thus the anti-weapon can be closing the altitude gap before it "knows" the exact approach vector. The path described by this anti-missile would take the form of an "S" curve.

■ Yet, there may be other, more effective means of intercept. At Loral, where fresh attacks on formalized thinking result in new concepts for defense, the broad approach to problems such as this is backed in depth by advanced research in such fields as electronic scanning and electro-optics. And from these probings come designs that our production teams turn into operational defense hardware.

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Yerkes Observatory photograph, taken October 23, 1911

objects and bring them all down. And, if only seven percent escape, you've had it.

In the case of the space domination you must remember that the satellites go around and around in the same orbit, and every time you try to get into a new orbit, you have to expend energy, throw away some weight, or be involved in some difficult operation.

Therefore, in this case, where you have time for discrimination and where the predictability is great, we have a very much easier task. If I had a choice I would tackle it first.

Then there are a number of other questions:

What about testing in space?

What kind of nuclear explosive do we need in order to bring down a satellite?

How will a nuclear explosive work in vacuum?

These experiments could be carried out so far in space that it would be hard or impossible to detect them. The Russians could do them in secret.

What about nuclear propulsion?

Nuclear power can give us the capability of accelerating, decelerating, zigzagging, at a small additional cost in weight.

Nuclear power, therefore, for the purpose of going to Venus and coming back, or for the purpose of maneuvering in space, in a possible space vehicle—all these things are extremely important, and nuclear power in space is indeed possible. I do not know what we should proceed with faster.

Now, I have but two more topics to mention, and one is *On the Beach.*

Ladies and gentlemen, I have never been as frightened in my life as I was when I read the book. I was not frightened because I believed what is said in the book. According to our present knowledge, it is not possible to wipe out the human race. If anybody would try to pursue this insane purpose, he would meet with enormous and unsolved technical difficulties and with equally great and justified human objections.

Furthermore, if somebody wanted to wipe out the human race, nuclear explosives would not be the easiest way to do it. There is a much more easy way, which people have had at their disposal for a century: bacteriological warfare. One could try to develop strains of bacteria which could do untold damage. This was never seriously considered by anyone. I think it is right that one should abstain from wholesale destruction which is not connected with defense.

The really frightening thing is not that such a thing will be undertaken. The systematic investigation, planning, expenditure will not be undertaken on this side of the ocean, and I am sure—whatever else I think about the massacrers of the Kremlin—they do not want to undertake it, either.

Human nature is above such things.

What frightened me in the book was something else:

Here is a challenge, the challenge of poisoned clouds in the atmosphere—and what is the response of the people to that challenge? Is it to try to find desperately, hopelessly, some way to escape it? To go underground, to find a method to clean up the air we breathe and purify the food we eat?

No emphasis is placed on these problems. The only question which is raised in the book is this: How to commit suicide easily?

That a book is written, that a book is believed, that a book is praised and admired, which states this horrible defeatist attitude about the whole human race—this is the thing that badly frightened me.

There is one other thing that makes me uneasy, and I would like to mention it and would like to conclude our discussion with it:

It is true that the space age is an age of advancing technology, and my good friend Horner has said rightly that a technological age gives some advantages to our country. I wish those advantages were greater. I wish that I did not have to remember that Russia today is graduating more scientists and more engineers than we are. I wish I did not have to remind you that Russian children devote to mathematics, physics, chemistry ten times more effort than our children do in this country.

There is a challenge, there is a danger. If we respond to this danger in the proper way, the world in which our children will live will be more secure, more wonderful, more challenging than we now can imagine.

If we do not respond to that challenge, the world in which our children will live will be a Communist world. I cannot predict the future, but I will predict it to this extent:

The world in which we live today will disappear and tomorrow will be unimaginably better or very much worse. Men will live in this world, and there is no question about the extinction of the human race.

Whether the great dream of a free society composed of individuals who can be individuals and who are free, whether this dream will survive, this is up to us.—END

THE MILITARY MISSION IN SPACE

"... if we are to be coldly realistic in our appraisal of space, we must take into account ... strategic advantages peculiar to the space environment ... advantages there for the nation with the courage and foresight to put them to use. ..."

SPACE—

Tomorrow's Battleground?

MAJ. GEN. OSMOND J. RITLAND, USAF

Commander, AF Ballistic Missile Division

THE development of ballistic missile weapon systems has accelerated this country's reach into space. By reacting positively to the urgent challenge of the ICBM concept, we have *defined, refined,* and *applied* sciences and technologies fundamental to the rocket and space age.

But, while ballistic missile technologies have led us to the space age, they are not sufficient in themselves to sustain us over the long road ahead. We have progressed far enough to begin considering space in its own right. It is a medium of untold potential, a frontier of infinite challenge. Our ultimate obligations in aerospace extend far deeper than ICBM trajectories.

For example, of the nineteen major programs currently assigned to the Air Force Ballistic Missile Division, all but five are—in fact—concerned with searching out the possible advantages suggested by space. The trend in research and development is clearly toward the vertical dimension.

I do not intend to dismiss the importance of continuing efforts to improve ballistic missile weapon systems, of our growing resources in operational Atlas ballistic missiles, of the imminence of the Titan II ICBMs with their abbreviated reaction time and extended range, and of the lower-cost solid-propellant Minuteman which will begin coming into our defense inventory in quantity after mid-1962.

Beyond these formidable weapon systems, we are studying possible follow-on missiles. These studies include but are not limited to a still smaller, lighter-weight, cheaper, and ever-less vulnerable ICBM—an ICBM of improved cost effectiveness over our present missiles.

But I would like to confine my remarks to space.

Our immediate goals are early warning, observation, and communications. These are the requirements of the hour, dictated by the peril of the times and by the raw facts of circumstance.

Thanks largely to our foundations in ballistic missile technologies, we have made good progress toward realizing our initial objectives in space. We have demonstrated through the Discoverer program an exceptional ability in the exacting jobs of boosting educated satellites into precise orbits, of stabilizing and commanding these vehicles on orbit, of communicating with them, and of recovering capsules ejected from orbit.

Actually, the most significant achievement wrung from the Discoverer program has been our demonstrated ability to inject instrumented satellites into narrow orbital planes and make them obey our wishes once they are there. The fact that we have proven one recovery theory does not mean that we are satisfied with the method we have adopted as being the best or most economical system possible. In fact, we have embarked on a priority effort to study the feasibility of developing a maneuverable capsule, to ensure easy recovery at a predetermined time and place.

Such development must surely come, but in these days of electronic revolution quantum jumps along the whole perimeter of requirements are not always possible.

To date, we have barely scratched the vast broad surface of aerospace. The mission of the

Air Research and Development Command is to develop superior weapon systems, and these include military space systems. In the prosecution of this mission, our intent is to never turn aside from a good idea. Good ideas abound in the fertile regions now awaiting the touch of man. Good ideas also are the raw materials of industry. I would like to suggest some of these ideas which have a strategic significance in this age, and to invite serious thinking on a question of mutual concern: Namely, where do we go from here?

Aside from our development of the Discoverer, Midas, and Samos satellite systems, we at AFBMD are engaged in five other major space programs, and are responsible for providing the boosters and launch capabilities for six other US programs. We are involved also in the Able series of space probes, the latest of which—Able V—has as its objective the first orbiting of a lunar vehicle.

In the area of space communications, we are cooperating with NASA and with the Army on the Advent program designed to feed eventually into a working global communications satellite system.

But, if we are to be coldly realistic in our appraisal of space, we must take into account other strategic advantages peculiar to the space environment—advantages there for the nation with the courage and the foresight to put them to use. For one thing, space is a possible battleground. Throughout time, on all the battlegrounds of history, the development of a revolutionary new weapon has precipitated the development of a means for defense against that weapon.

The ICBM is no exception. It travels through space. Considering the blinding speed and small size of the ballistic missile reentry vehicle, it would seem prudent that we consider ways and means of intercepting and destroying such weapons at a point early in their period of powered flight.

One way which suggests itself is in the development of orbiting sentinels—interceptor satellites capable of sensing the heat that marks a ballistic missile launch and capable of instantly dispatching rockets to destroy the aggressor missiles.

These then, are the principal programs conceived as our next generation of requirements beyond Midas and Samos. At the same time, we at AFBMD are responsible for boosting the payloads required by the Transit, Tiros, Courier, Mercury, Dyna-Soar, and 609-A [hypersonic test environment] programs.

The increasing responsibilities we must expect to assume, and fulfill, in the evolution of our capabilities during the next few years have prompted serious consideration of two requirements peculiar to our military space operations. One is the boosting of large numbers of satellites into the celestial traffic pattern. The other is the chore of economically maintaining these satellite systems once they are put into place.

The hard fact of life is just this: We can't afford a usable force structure in space unless the cost of placing payloads in orbit is reduced one order of magnitude or more.

One possible way of reducing costs is by development of recoverable booster techniques. Or we may arrive at a lower per-pound-of-payload cost by designing and using a military launching vehicle system featuring a more economical booster. At present we are assessing the technical feasibility of each of these approaches.

However we solve the problem—and we will solve it, for America's place in space cannot be denied—we must recognize that our requirements must include capabilities for regular and frequent launchings, for flexibility in missions, for high reliability and adaptability to various purposes, for maximum simplicity, and for the employment of multiple payloads per launch.

Now, further, if we are to put networks of productive military-purpose satellites into orbits, we must ensure the uninterrupted operation of their complex electronic and mechanical equipment. Our experience to date with electronic gear in space indicates that we must continually improve our reliability. In short, reliability is tough to come by, and a lot of hardware is going to have to be boosted and kept in working order. One of our most pressing requirements, therefore, is the enlargement of our reliability quotient.

In this connection, on the basis of investigative studies, we have evolved a concept we call SMART —for "satellite maintenance and repair techniques." Present indications point toward an actual economic advantage to be accrued from manned maintenance systems for orbital payloads—a true military reason for putting men into space.—END

General Ritland, Commander of the Air Force Ballistic Missile Division, is a veteran airman whose experience includes test pilotry and important research and development posts in the Air Force. Assigned to AFBMD almost from its inception, General Ritland became its head in 1959, after service as AFBMD Vice Commander.

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POINTS OF DEPARTURE

THE STROMBERG-CARLSON SYSTEMS MANAGEMENT TEAM HEADS...???

We can't give you the details yet, but we can report that Stromberg-Carlson has been asked to head up the development program for a passive reconnaissance network. Stromberg-Carlson won the nod on the strength of its Core Concept of Systems management, which helped get the project off and winging in short order . . . and on its long-standing sophistication in all aspects of advanced electronics and communications, military and commercial.

in SYSTEMS MANAGEMENT:

We're ready to launch your project as well—*now*. Because Core Concept maintains a permanent staff of top scientists, engineers, technicians, cost-scheduling and managerial talent, Stromberg-Carlson is always tooled up for any problems that arise within the rather extensive perimeters of its competence. Seasoned and dynamic, the Core Concept staff can line up contributing sub-contractor firms and get well underway on system projects of all types—in the time it previously took just to assemble a systems management group.

There's a very simple yardstick for measuring the speed and efficiency of Core Concept. Money. It's expected that Core Concept organization and administration can cut systems management cost significantly.

In what areas are we qualified? Well, we're involved in radar development for missile tracking systems. We've achieved several breakthroughs in solid-state circuitry and modularization of computer systems. We've had over 65 years in every phase of telephone communications. We produce radio sending and receiving equipment for land, sea, air and space. And we're right up there in high-speed teleprinters and electronic display techniques. Look on Stromberg-Carlson as a supermarket for systems, ideas and talent—to serve you.

FISHING FOR SUBMARINES . . . FROM THE AIR. SOME NEW IDEAS FROM S. C.

Efficient detection of underseas targets from swift-ranging aircraft will require new non-acoustic techniques. Stromberg-Carlson scientists think that a research program now in progress has important applications to these techniques. Under investigation are low-frequency electromagnetic phenomena, interplanetary plasma physics, and other geophysical processes which produce electromagnetic "noise."

in COMMUNICATIONS RESEARCH:

In present non-acoustic methods of detection from the air, the signal strength is frequently weak and always decays rapidly with distance; it soon disappears in the ever-present background noise.

Already, several signal processing techniques resulting from Stromberg-Carlson noise studies have been developed and tested. These show performance gains which promise to offset partially the loss in signal with distance through more effective discrimination against background noise.

The investigation of geophysical and astrophysical phenomena will include study of electromagnetic background noise at the earth's surface in the frequency region of 0.001 to 10,000 cps, solar radio signals and the interplanetary medium. Knowledge in this field of interest is growing rapidly, and worthwhile scientific contributions resulting from the planned work are almost certain.

In the course of investigation, Stromberg-Carlson scientists also propose to determine the relationship between the characteristics of the earth's surface and the low-frequency electromagnetic background and to examine the noise spectrum for types of signals hitherto unknown.

This program is only one of Stromberg-Carlson's numerous basic research projects currently underway in all areas of electronics and communications.

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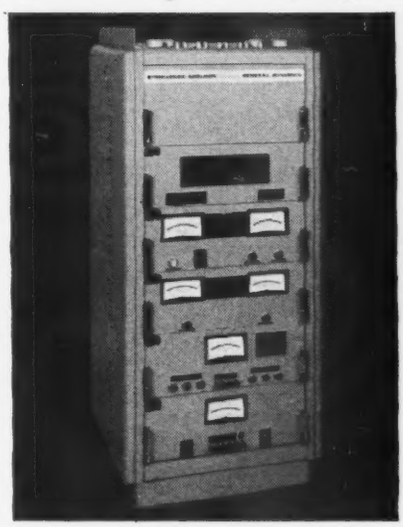

in ELECTRONIC EQUIPMENT:

the offending part is flashed on the annunciator. Even an unskilled operator can then pull the module containing the flaw and plug in a replacement—all in a matter of minutes. Previously, it took hours, even days, to get a nuclear reactor back into operation.

But this is merely the spectacular phase. More mundane, but more to the point in reducing reactor down time, is the simple fact that malfunctions *are* so rare.

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Right now, Stromberg-Carlson control systems are used with Detroit Edison's Enrico Fermi reactor . . . and will handle the Army's Ice Cap reactor — a portable, skid-mounted unit that will feed power to a Dew Line station in Greenland.

Stromberg-Carlson systems provide instrumentation throughout a reactor's entire operating range, from the moment of start-up. An overlap of two decades in the source, intermediate and power ranges assures continuous monitoring. Light and compact, these systems can control marine, portable, research, or commercial reactors.

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Speaking of SPACE

WILLIAM LEAVITT
Associate Editor

November 3 saw successful launch of US Explorer VIII, Ionospheric Direct Measurement Satellite, designed to explore ionosphere. NASA technicians are shown conducting electronic payload check.

The Sky May Not, After All, Be the Limit

Late in 1959, in the course of a RAND Corporation-sponsored conference on the international implications of activities in space, held in Washington, D. C., Amrom Katz, a witty scientist who is considered an expert in the area of satellite reconnaissance, remarked tellingly:

"There are a great number of legitimate, scientific explorations that can be undertaken [in space]. . . . There are, also, many military applications. In fact, this is the real reason for all the current space effort. We didn't get into this business simply because Guatemala put up a satellite to take measurements of cosmic rays. It's because the Russians did it. . . .

Dr. Katz was not being frivolous. During the course of the conference, he dispassionately commented on the possibility of bombing from satellites, decoy satellites, and other items suggestive of serious uses of space for military purposes—purposes which amount to astronautical extensions of traditional military functions. Dr. Katz was not, of course, making outright predictions that such military functions would extend into the space arena, but he was pointing up a fact that must be faced by those who have belittled the potential military significance of space since that jarring day of October 4, 1957, when the Soviets announced that they had launched the first man-made satellite into orbit.

Since that day in 1957, there has been a continuing debate on many levels on the question of the military significance of space. An indication of the dominant opinion in the outgoing Administration, at least in the first two years after Sputnik, that the military significance seemed small, was the post-Sputnik organization of the space effort. The scientific aspect was acknowledged with a clear charter to the National Aeronautics and Space Administration. But only grudging acceptance of a potential military mission was symbolized by what seemed leisurely and scattered handling in an unenthusiastic Department of Defense. It has only been in the past year that the Administration, spurred by the U-2 reconnaissance incident and by the campaigns of military and scientific planners for recognition of the great potential of reconnaissance and early-warning satellite systems, has begun to accept the idea that conflict and weaponry, as they have throughout history, will extend themselves in keeping with advancing technology.

The only questions are how, how much, and how soon? Indeed, the consensus of the material from the Air Force Association Convention symposium on the military mission in space, published in this issue of SPACE DIGEST, is that although space will obviously be a vastly important scientific tool, the military potential is certainly foreseeable. The differences among Symposium participants and panelists Doolittle, Horner, Sut-

ton, and Teller seem to be mostly of degree, with General Doolittle and Dr. Teller stressing the astromilitary end product and Messrs. Horner and Sutton stressing the criteria and technical problems involved.

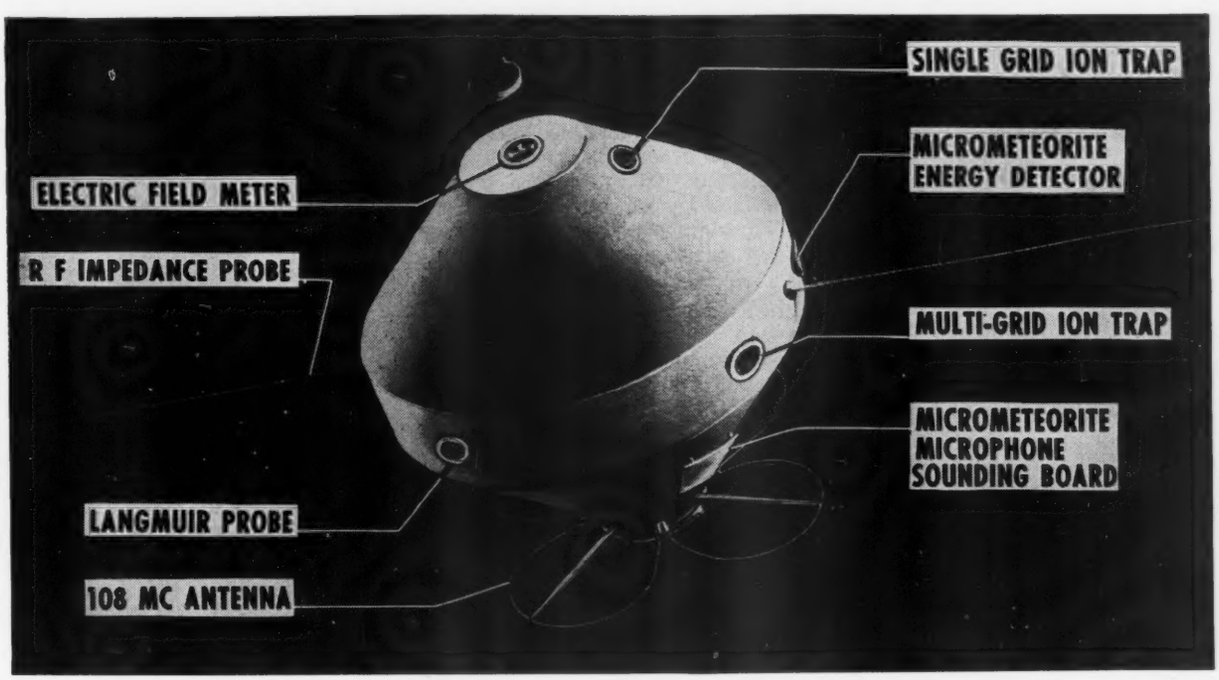
Thus far, in discussions of military space utility, the emphasis has been on essentially passive items such as reconnaissance, early-warning, communications, and navigational satellite systems. These come under the category of "support systems" in the terminology of Mr. Sutton, and as of now, they are probably the only safely foreseeable military systems.

But "safely" is a highly qualifying term in this context. In the March 1958 issue of AIR FORCE we commented that man in space would become a meaningful scientific or military reality only when man could choose his point of departure into the new medium, maneuver at will in the medium, and return to his landing place in a controlled manner. Air Force efforts such as the X-15 and follow-on Dyna-Soar programs are moves in the direction of controlled aerospace flight. And there is increasing evidence of strong Air Force interest in systems that truly would dwarf the planned X-15 and Dyna-Soar programs. It is a reflection of the speed of conceptual developments in this technological age that serious Air Force thought is being given to aerospace systems wherein manned space vehicles would, using various techniques geared to the particular stage of the flight, take off from the ground with chemical rocket assist, absorb oxygen for fueling purposes from the upper reaches of the atmosphere, for mixture with onboard hydrogen supply, then proceed on controlled flight through the space medium.

This is a truly staggering concept, if workable. But even if it does not prove out, certainly advances in nuclear technology are eventually going to enable manned controlled flight in space. One approach to the nuclear rocket flight concept was published on these pages only a few months ago, "Nuclear Cycling into Space," by Thomas Szekely in August 1960. Lead time, money, concentration of effort, management methods, enormous technical problems, are stumbling blocks, but not the imagination.

Technological Oligarchy or Educated Citizenry?

The transformed world described above in military-technological terms will be transformed in other ways too, of course. The space age, if we do not prepare for its impact now, could become a



Artists' sketch of Explorer VIII payload shows eight experiments designed for its space mission. The ninety-pound satellite, thirty inches high and thirty inches in diameter, is in a highly elliptical orbit. NASA hopes to garner considerable direct observation data on the nature of the highly important ionosphere.

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new Dark Age, with mankind dividing into two groups—those who understand the new technology, and those who do not. Given time enough, an intellectual technical elite minority could assume control of a world in which the great mass of people were helpless and without will in a maze of machinery and systems unintelligible to them. From that dreary point, it would be, perhaps, a short step to a time of technological tyranny by a small elite over faceless masses.

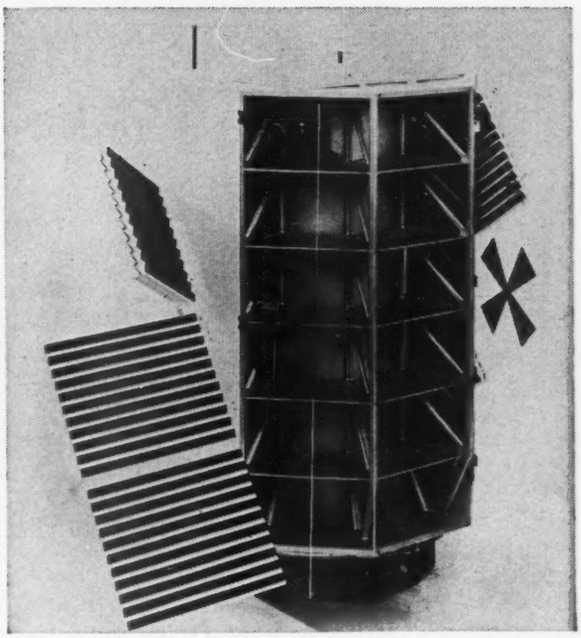
Wayne O. Reed, US Deputy Commissioner of Education, and a strong advocate of education for the aerospace age, made a speech recently to a meeting of Colorado educators, in which he warned of this danger. It is worth quoting from:

"The imminence of this new world . . . and its fantastic novelty have powerful implications for the educator. No man can understand such a world, or even have access to it, unless he has been prepared for it. The unprepared man portends too great a hazard to himself and to others. Even if he could enter it, no man can learn to understand this world merely by living in it. Actually, it cannot exist for him until he has developed the concepts for it—insights from astronomy, from physics, from mathematics, from biology, from economics, from psychiatry.

"Many of these concepts were themselves unknown to man fifty years ago. Quite understandably, many of them are now missing from the curriculum of the schools. Long before we have learned how to get them into the curriculum, a host of other crucial concepts from the frontiers will be crowded in, requiring their due placement in order that men may be prepared to know this new world and to cope with it. . . .

"I am convinced that much of what we now teach in colleges we must learn to teach in high schools; moreover that all our schools must learn to teach many concepts which are fundamental but which are not as yet taught anywhere. I am equally sure that the old fundamentals are not obsolete; they are enlarged. I am certain that every pupil must be made to know more. . . .

"Let me say . . . with the utmost seriousness that failure to solve this curricular problem may have grave consequences in our society. If for lack of vision we fail to prepare everyone for a world which makes unprecedented demands for the prepared man, it is probable that a new dualism will develop in our society. In this dualism there may be on the one hand a sophisticated minority quite capable of shaping the new world as they envision it, and on the other hand a majority incapable either of understanding or coping with a world of which they are less a vital part."



Grumman Aircraft's proposed eight-sided orbiting astronomical laboratory, development of which NASA is negotiating currently. Weighing 3,200 pounds, the Grumman OAO might be launched in 1963, according to plans by civil space agency.

British Space Program—The Developing Debate on the Pros and Cons

The November issue of the *Bulletin of the Atomic Scientists* carries an interesting report on a matter which has been previously partially covered on these pages, the question of whether Britain ought to proceed with a vigorous, independent space program. A strong pro on the question was registered by Kenneth W. Gatland in his article, "British Space Policy—A Dissent," which appeared in SPACE DIGEST in February 1960. Gatland, a veteran British supporter of astronautical research, took strong issue with what then appeared to be a developing British government policy to limit sharply national investment in a space research program. He argued then that existing British rocket capability constituted a sturdy foundation for British space achievements, and that technological progress in the United Kingdom would suffer, along with national prestige, if the country did not establish a vigorous program.

The argument in England has, says the *Bulletin,* intensified since last summer's British announc-

Monkey business shows up in advertising series by Endevco Corp., of Pasadena, Calif. Endevco, which produces electronic equipment, is using "life in space" motif for current ad campaign.

ment that the country would not proceed with development of the British Blue Streak missile, described as a second-generation Thor, after a heavy investment had been made in its development.

After the abandonment of the Blue Streak program, space research supporters suggested that Blue Streak could be combined with the British Black Knight rocket research vehicle for a British one-ton satellite capability.

The important Advisory Council on Scientific Policy has generally advised the government against British investment in an independent space research program, suggesting alternatively that Britain use payload space aboard US-NASA vehicles for desired experiments.

Big British scientific names are ranged on opposing sides of the argument. The well known Prof. A. C. B. Lovell, Director of the Jodrell Bank observatory of the University of Manchester, which tracked the US Pioneer and Russian lunar impact vehicles, has written pessimistically of the future of British science operating "piggy-back" with the spacelift facilities of other nations.

"Already, the marginal encouragement given . . . British scientists to design experiments has yielded more hardware than can be accommodated in the [US] Scout vehicles and ideas for astronomical observations from stabilized platforms which could be available from the Blue Streak program long before they are likely to be offered by other countries." He added, pointedly, in his article in a recent issue of the *New Scientist,* that British scientists might move to the US "if their ambitions cannot find an outlet in the United Kingdom."

Against charges by some that a British space program would be a sort of "keeping up with the Joneses" effort, Professor Lovell replied that the already-made discoveries such as the Van Allen radiation belts were giant steps for science, and that on the military side, even though Britain had abandoned reliance on offensive missiles, she could not afford to forfeit rocketry know-how as part of her defense capability.

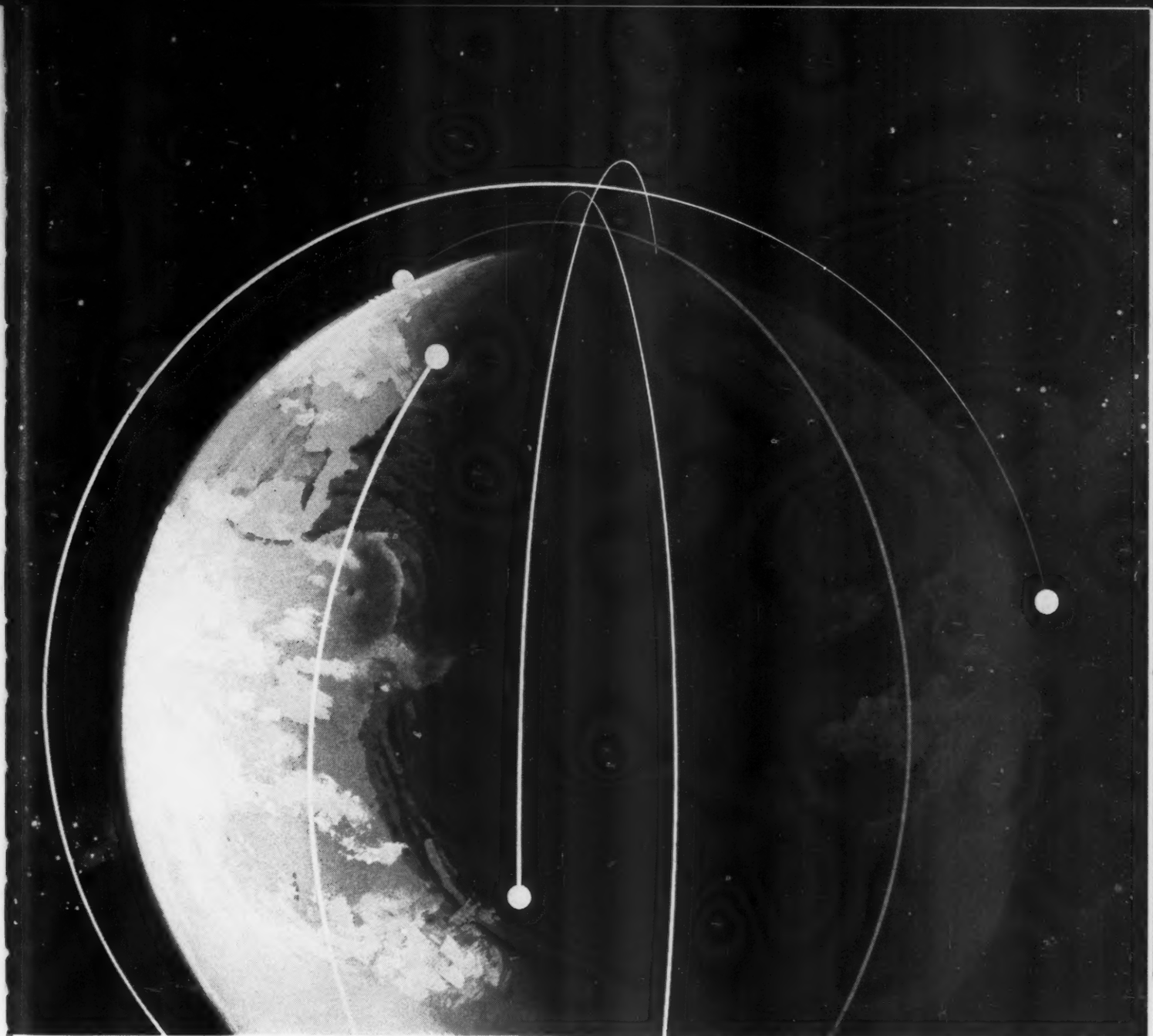
This column had an interesting letter exchange with the professor recently. After seeing a press report to the effect that the professor had been denied desired payload space for experiments aboard US vehicles and had written the Russians asking for room aboard their vehicles, we asked him if it was true.

He wrote, and we quote in part:

"It is the British authorities, not the American, who inform me that there will not be room in these Scout vehicles for our experiment. Because of this I wrote . . . to the President of the Academy of Sciences of the USSR to request space in a future Soviet satellite. I have not received [as of September 22] any direct reply, but I have indication from visitors that the request is receiving favorable consideration. The indication which I have been given would suggest that this specific request may lead the USSR to offer an international satellite. . . . You must not take this as meaning. . . . I have any indication that such an offer will be made. . . . I am only indicating possible lines of development."

On the con side is astronomer Fred Hoyle of Cambridge University, who feels space research is but a part of astronomy, which in turn is only part of over-all science, and that stress on space research would overmagnify its importance as a small segment of science. Professor Hoyle fears no exodus of British science talent.

It will probably not be too long before a firm decision is taken by the British government on the nature of its space effort. The decision possibly will be an indicator of European views on the desirability of membership in the astronautical club.—END



Midas satellites: our infrared eyes in space

Should enemy missiles ever be launched against America, they would plunge down upon us in just thirty minutes. They would be halfway here before the first warning blip showed up on our earthbound radar screens. But our Midas satellites will warn us within seconds. Their infrared eyes will "see" any missile's white-hot exhaust as soon as it leaves the earth's atmosphere, even thousands of miles distant. Just a few of these satellites, circling the earth on pole-to-pole orbits, will be enough to keep every acre of land and sea under constant surveillance. By doubling our warning time, Midas will give us precious extra minutes to get our long-range bombers off the ground and our intercontinental missiles ready to launch—and thus render futile any hope of destroying our military might with one bold stroke. Midas will become a reality years sooner because it is based on the Agena satellite which Lockheed developed for the trail-blazing Discoverer program of the U.S. Air Force. Lockheed is now building Midas satellites for the Air Force at "Satellite Center, U.S.A."—its Missiles & Space Division at Sunnyvale, California.

LOCKHEED

MISSILES & SPACE DIVISION, SUNNYVALE, CALIFORNIA

cppc's design and manufacture of critical guidance and control components, systems and computers for the Nation's defense, renders us totally involved in America's future.

We are not dissatisfied with this arrangement.

We believe America is going to meet its many challenges. We are working to meet ours—in the fields of RELIABILITY, QUALITY, ACCURACY.

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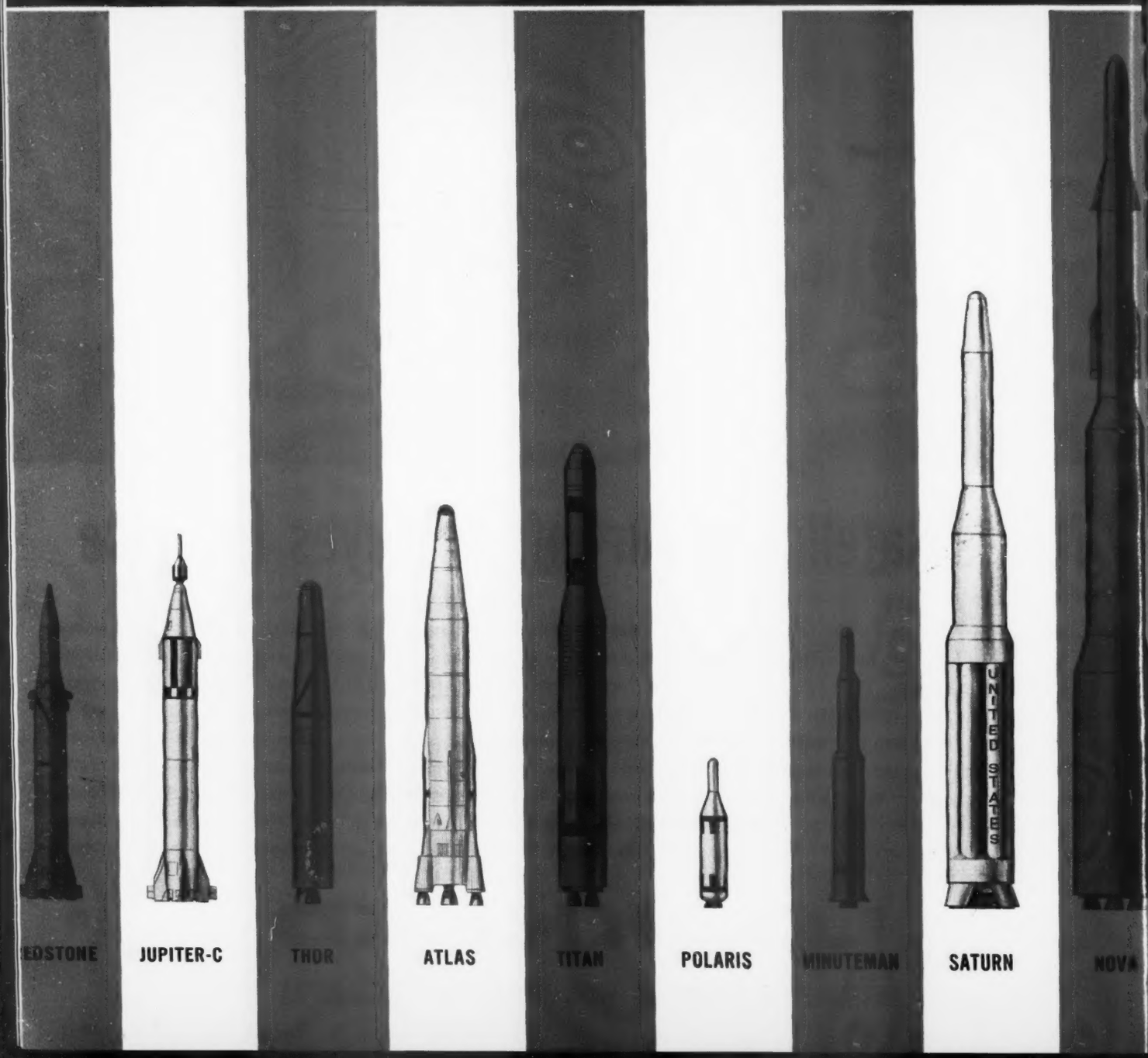

AIR

AIR FORCE
DECEMBER 1960

USAF can take the credit for weapon systems that are produced on time and provide combat capability when delivered. USAF also must take the blame when this is not true. With the advent of the missile age and the coming transition to carry out a military mission in space, basic organization changes were needed to help in . . .

MOBILIZING INDUSTRIAL KNOW-HOW

The US Air Force looks upon weapon system management as the most critical element of the defense effort on the eve of the military space age. Out of the gargantuan effort of the past few years to practice concurrency and compress the time cycle for the production of ballistic missiles there has evolved a new type of Air Force management organization that now is keyed to the burdens that lie ahead as weapons continue to go higher and faster. In addition to great steps in propulsion, guidance, miniaturization, materials, and other hardware areas, the experience with ballistic missiles teaches continuing lessons that USAF will carry into the space era.

"The industrial and scientific know-how has been available all along," says Lt. Gen. Bernard A. Schriever, Chief of the Air Research and Development Command. "Mobilizing it has been the problem . . . the pacing factor in our progress today is not technology but management. . . ."

Top responsibility for system management, in the space age as in all others, is a responsibility of the Air Force, and it is one that cannot be passed to anyone else. Exercising this responsibility has, in the past couple of years alone, spawned new commands within both ARDC and the Air Materiel Command. Command and control, electronic systems, aeronautical systems, and missiles themselves have required more specialized and centralized attention by management. The magnitude of the job, having left USAF with a deficit of manpower in this area, has forced the formation of outside brain trusts, such as the MITRE Corporation in the command and control area, and the newer Aerospace Corporation with a mission in the formulation of system concepts and specifications. The latter company, to be staffed with the best possible talent, will maintain a steadily lessening but firm supervision as each project proceeds from concept to operation. It is important to note that in the military missile and space age this control will last from concept to operation, not from concept to delivery, as was the case when a weapon system was a sophisticated airplane.

A complete explanation of the evolving USAF management system was given contractor represen-

tatives at the Industry Seminar of the 1960 Air Force Association Convention at San Francisco on September 23.

Chaired by Dr. George Valley, a professor at the Massachusetts Institute of Technology and former USAF Chief Scientist, the meeting heard presentations by top military and civilian executives from both the Air Research and Development Command and Air Materiel Command organizations. The speakers:

- Lt. Gen. Bernard A. Schriever, *Commander, ARDC.*
- Maj. Gen. Kenneth P. Bergquist, *Commander, AF Command and Control Development Division, ARDC.*
- C. W. Halligan, *President, The MITRE Corporation.*
- Maj. Gen. Osmond J. Ritland, *Commander, AF Ballistic Missile Division, ARDC.*
- Dr. Ivan A. Getting, *President, Aerospace Corporation.*
- Lt. Gen. William F. McKee, *Vice Commander, AMC.*
- Maj. Gen. Clyde H. Mitchell, *Commander, AMC Electronic Systems Center.*
- Maj. Gen. Waymond A. Davis, *Commander, AMC Aeronautical Systems Center.*
- Maj. Gen. Thomas P. Gerrity, *Commander, AMC Ballistic Missiles Center.*

Dr. Valley, at the outset, made it clear why USAF must maintain an increasingly close supervision over weapons development and production in the missile and military space age. It is part of the struggle against communism, he said, to make the best possible use of time. And adequate management is what will make this possible.

General Ritland, whose command will exercise USAF's responsibility during critical parts of the history of each new missile and space system, told AFA's industry representatives some of the requirements that lie ahead. He added this assurance:

"The reliance we have placed on industry in the past ten years—for directed research, inventive imagination, and technical advances—now appears modest in comparison to the challenges emerging in the unfolding of space. . . . The partnership the Air Force and industry have established is expanding. . . . The challenge is unprecedented."

Because most of General Ritland's presentation dealt with a look into the future of the military mission in space, the bulk of his remarks have been incorporated into our report on that subject in this issue of Space Digest. *They appear on page 89.*

Abstracts of the other papers delivered at the Industry Seminar follow.—The Editors

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MANAGEMENT of large programs by the government—and more specifically by the Air Force—is a comparatively new problem in this country, brought on by the urgent necessities of this nuclear rocket era. Let me use the situation we faced at ARDC's Ballistic Missile Division as an example. We came out to California in 1954. Our fiscal year '54 budget amounted to $4 million. We had, in fact, in the Air Force, spent about $20 million over a period of ten years on ballistic missiles. Most of that expense was for study and some experiment.

Our budget at BMD this year, for ballistic missile and space activities, is just about $3 billion. The agencies involved in the over-all effort are military, industrial, and scientific. We have ARDC, we have AMC, we have SAC, we have the Air Training Command, and of course we have Headquarters USAF, representing the government. In industry, we have many major companies. Also, the scientific fraternity has been an active participant right from the start.

All this means people, organization, policies, procedures, and many other administrative problems. In addition, we have adopted the philosophy of concurrency in our major weapon system programs. That means we have attempted at the same time to do research and development, production, the training of people, creation of new organizations, building new operational environments, establishing new logistic systems.

In the last six years, something like $10 billion has been put into ballistic missile and space programs.

The industrial and scientific know-how has been available all along. Mobilizing it has been the problem. I have come to the conclusion—and I have held this opinion for some years—that the pacing factor in our progress today is not technology, but management. And we live in an age when we can no longer afford to muddle through.

At this moment, it is a technological war, brought on by the amazing outburst of creative technology in the last two decades. The primary concern that should motivate all of us is to apply this exploding technology to our military effort, so that we will win the war of survival.

The job we have to face in the armed forces, and more specifically in ARDC, is to determine how we can best apply technology to the problem of reducing the lead time between a concept and an operational weapon system. If we fail to do this, our weapons will become obsolete before we build them. My concern is to ensure that ARDC management will be geared to take advantage of the new technology, which you and many other Americans are providing.

This country was involved in two major wars during the first half of the present century. Both were won by production. We know that we will not have the same situation again. Even so, it is hard to change people, policies, organizations, attitudes, and vested interests, which have grown up over many years. In war, historically, it has been our tendency to fight the last one over. We have been handicapped by experience. Thanks to experience, man is always adept at solving yesterday's problems.

Our concern now is: How can we manage military R&D effectively and efficiently, to ensure prompt application of important new discoveries to military weaponry, and to provide for proper utilization of R&D resources, people, facilities, and dollars?

MANAGEMENT'S KEY TO SURVIVAL

Lt. Gen. Bernard A. Schriever, USAF

COMMANDER, AIR RESEARCH AND DEVELOPMENT COMMAND

General Schriever has been ARDC Commander since April 1959. From 1954 to 1959 he headed USAF's Ballistic Missile Division, a component of ARDC, through the early days of US missile development. General Schriever saw extensive duty as pilot and commander of heavy bombers in the southwest Pacific during World War II.

We have made a reasonable start at BMD by adopting the concept of concurrency—the overlapping phases of research, development, test, and production—as one method of shortening lead time. The reorganization of ARDC has meant the formation of three development divisions: BMD here on the coast, for ballistic missile and space activities; Wright Air Development Division in Dayton, for aeronautical systems; and the newly created Command and Control Development Division at Hanscom Field, near Boston. These development divisions are now the operating management level of ARDC.

In addition, the Air Force only a few weeks ago approved a set of regulations on weapon system management, applying to all high-priority systems.

These regulations will expand the pattern of BMD and BMC, to put it in effect at all our development divisions and AMC centers. In my opinion, the new regulations—known as the 375 series on systems management—will assist materially in the compression of time. Specifically, they provide for the designation of a single agency, with over-all management responsibility, during all phases of weapons acquisition.

In our preoccupation with organizational changes within ARDC, and with the realignment of management responsibilities within the Air Force, we may be prone to overlook one of the most significant evolutions which have occurred in management. At the present time, we are welcoming a new partner in the management of weapon-system programs. The Aerospace Corporation has now joined the Space Technology Laboratories and BMD in supervising the progress of these development projects.

(Continued on following page)

The evolution of organizations such as Aerospace and MITRE Corporation mark the most significant change in our management policy since the technological explosion began. Why have these organizations become necessary? The answer is quite simple. While the scope of research and development has changed, the in-house resources available to the Air Force have not changed.

At the end of World War II, the military services had an in-house capability sufficient to maintain a force in being, and to improve incrementally the performance of our systems. But the growth of technology has forced us to apply more and more technical management to our programs.

Within the past few years, the weapon system concept has come to the front. This is not just an arbitrary or theoretical approach. It is a concept forced upon us by the rapidity with which new developments have been brought into being. Weight, size, and performance are more critical than ever before. The interrelationship of each subsystem to the over-all weapon system assumes major importance. Today there is an overriding need for integration among several weapon systems. This is particularly true in the command and control areas.

The increasing complexity of our systems, the increasing advent of new technologies, have made it more apparent that no single contractor could be best qualified in each of the myriad of specialized areas required for modern weapon systems. The Air Force now requires the services of those contractors who are best qualified in each of the specialized sciences. In this way, the concept of the associate prime contractor was born.

Concurrently, our need for the system approach to development has been increasing. In the ballistic missile and space programs, we are concerned not only with the aerospace vehicle, but also with the penetration of a new environment, in which they must operate. Each new system creates requirements in a multitude of sciences and areas. To bring the special capability of each industry to bear, while at the same time recognizing the interrelationship of all, has made it necessary for the Air Force to call into being new agencies, concerned primarily with engineering the total system and with integration of the various subsystems.

I do not want to minimize the outstanding contributions made by our Air Force engineers and scientists, in our own laboratories. However, the very nature of this meeting and the large expansion in the budget for research and development are two indications of a sharply accelerated growth in our requirements.

Instead of expanding since 1950, manpower available to the Air Force—and particularly to ARDC—has contracted. Today we utilize companies like ARO at our Arnold Engineering Development Center, Vitro at the Eglin Gulf Test Range, and Pan American and RCA at the Atlantic Missile Range, to assist us in carrying out our test and evaluation functions. These are jobs that fifteen years ago were handled entirely within the Air Force. Our relationship with these companies reflects growing requirements.

When we add to it the further need for integration of the best industrial contractors we can find, the magnitude of the problem facing the Air Force today becomes clear. We simply do not have, internally, all the manpower resources necessary to carry out the technical management of all our programs.

I do *not* want to leave with you the impression that we lack the competence, within the Air Force, to manage complicated technical programs. We *do* have this managerial competence. We will continue to have the capability for technical management, and will continue to expand it. For example, at our Wright Air Development Division, we are reorienting many of our technical people, and building up a system engineering capability to manage the most complex aerodynamic systems, such as the Dyna-Soar.

However, the total requirement for personnel of this kind, throughout the Air Force, far exceeds the number of people we now have, or can hope to get. I foresee a continuing need to employ objective organizations, which can provide the Air Force with additional technical competence. Aerospace and MITRE Corporations have an essential part in our long-range planning.

I recognize that industry sometimes objects to technical supervision from any source. Yet I am convinced that the results achieved by this type of management have been beneficial—not only to the Air Force, but to industry as well. Contractors who have had experience with this policy, by participating with the United States Air Force in the successful programs undertaken in recent years, recognize this fact.

The existence of a strong technical management group—available to the Air Force for system engineering, analysis, and review—in my opinion has had a progressive influence on contractors, by stimulating them to increase their own internal technical competence. The result of this increasing competence is a lasting benefit to every company which has acquired it, and is a lasting benefit to the Air Force and the country as well.

For the future, we can expect an increasing percentage of the total effort expended by both the Air Force and by industry to be channeled into research and development. We can expect a reversal of the long-accepted trend toward more costly and more complicated systems, and we must deliberately work for a reversal of this trend. We must take all necessary steps to ensure the compression of time. It can be done but only if all the resources available in science, industry, and the military services are employed with the utmost efficiency toward the common goal.

Technological supremacy will mean the survival of our nation and our free way of life. We have the resources and the technical know-how to ensure that we gain and keep this technological supremacy. Management is the key to our continuing progress—and to our survival.—END

'CRISIS IN COMMAND'

Maj. Gen. Kenneth P. Bergquist, USAF

COMMANDER, AIR FORCE COMMAND AND CONTROL DEVELOPMENT DIVISION, ARDC

General Bergquist became Commander, Air Defense Systems Integration Division, predecessor organization to the youthful Command and Control Development Division, in 1958. Previously, he served as Director of Operations at Hq. USAF from 1955 to 1957 and as Deputy Chief of Staff, Operations, in 1957 and 1958.

THE JOB we face in the armed forces, and more specifically in ARDC, is to determine how we can best apply technology to the problem of reducing the lead time between a concept and an operational weapon system.

Relating this task to the functioning of the systems comprising the command and control systems area, General Schriever in October 1959 directed that studies be made to place these systems in a realistic time frame in view of the present and future state of the art and the need to evaluate these systems on an inter- and intrasystem basis.

There were assembled at Hanscom Field nearly 140 representatives from scientific, industry, and military agencies to consider this problem. This group has become known as the "Winter Study Group."

The Winter Study Group was established to "examine critically and objectively from a technical point of view the entire complex of existing and planned Air Force command and control systems. This includes an examination for technical realism of the needs and objectives of the individual Air Force operating elements, as well as a study of the problems associated with the integration of the various systems."

At the outset, the group recognized that revolutionary advances in the destructive power of weapons and in the speed and range of delivery systems have created a "crisis in command." The extreme quantity and abstract quality of data, the compression of decision time, and the necessity for rigid central control to avoid accidents, have imposed this crisis on the operational commanders. The Air Force has taken preliminary steps to meet this crisis by initiating individual and independent mechanical command and control systems.

Some of the most severe requirements imposed upon the command and control systems come from the compression of time, which has a serious implication in strategic war, especially in relation to our response to a surprise attack when our warning time is measured in minutes. Mechanization addressed to the compression of time often seems to imply a system which would gather data on the enemy attack, process, evaluate, transmit, and display it to a decision-maker in a form which would enable him to decide to retaliate in time to transmit the firing order to our forces. The quick reaction time of missiles makes them an ideal weapon for surprise attack, that is, for a "first strike."

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However, a retaliatory, or second-strike capability for missiles need not be based on quick reaction alone. It can also be based upon another unique feature of missiles, namely, their ability to survive an attack through a combination of back-up or dispersal with hardness or mobility, a combination which can be called "survivability." The choice between quick reaction and survivability has a crucial effect upon requirements for command and control systems. A quick-reacting force requires a highly reliable, high-data-rate system. However, if the force depends entirely on quick reaction, the command and control system can also be soft. There is no point in having a hardened system to control a soft force. On the other hand a second-strike capability based on a hardened force requires a command and control system which could survive with the force and control it.

Perhaps the best solution to the compression of time is not elaborate electronic equipment intended to make quick reactions safe but a survivable and perhaps quite simple system to make quick reaction and snap judgment unnecessary.

There is a real danger that command and control systems will "fall between two stools," being neither reliable enough to permit us to launch a quick strike before being hit by a surprise attack nor survivable enough to control our reaction after being hit.

From a program sense, more attention must be paid to planning in the early conceptual phases of these systems to ensure that the need is sound, that the systems are achievable from the viewpoint of the state of the art and that sufficient analysis is conducted to ensure that the system is within reasonable or anticipated resources. Particular emphasis must be placed upon a costing analysis of an unborn command and control system.

Additionally, we must pay more attention to the broad integration factors in the current pursuit of separate and independent mechanized command and and control systems. The ability to control force throughout the duration of hostilities and to be capable of rapidly communicating between the automatic systems (this implies machine vocabulary standardization) is more important than purely technical integration factors. Lack of compatibility could well translate itself into an eventual loss of control of the force.

The wide use of data-processing systems holds high promise of relieving stress on the modern decision-maker and of relieving the crisis in command. Thus, the USAF should acquire an ever-increasing technical competence within its officer corps in the specialty areas of electronics, data processing, and computer programing. These latter two categories constitute a vital portion of the command function and, therefore, must be performed or at least supervised by military personnel.

Individually, most of the command and control systems appear to meet the requirements as presently stated and are technically feasible. However, collectively they fail to pass the conceptual, integration, and costing criteria. Further, while industry most likely will continue to serve as the actual developer and producer in the implementation phases, much more detailed guidance as to design emphasis and intersystem compatibility must be supplied to industry by the design agency.

There needs to be an adequate comprehension of the evolutionary nature of these systems; also an appreciation of the fact that they may force unwanted changes to the organizations that use them. The real problem is one of how to *control the force,* and not one of acquisition of mechanized equipment. Some hardware is obviously involved, but this is not the heart of the problem. The real issue is one of identifying the problem, understanding the use of command and control systems, and establishing the proper management facilities to do the job.

The problems encountered in the individual command and control systems are facets of a much bigger and more fundamental problem, i.e. "What agency has the over-all responsibility for the design of the command and control systems, the systems that control the forces of the USAF?" Inasmuch as these systems are assuming increasing importance, it is essential to identify a prime agency having complete systems design capability and responsibility. Creation of the Hanscom complex was a preliminary step in this direction.

The Hanscom complex currently includes a number of USAF and supporting organizations which function as a team to propose, develop, and provide command and control electronic systems. Major residents are: ARDC's Air Force Command and Control Development Division, responsible for research and development management; AMC's Electronic Systems Center, the logistic team member; and ADC's Command and Control Defense System Office, the representative of a major combat Command. Rome Air Development Center provides support utilizing its laboratory and test facilities and contractors. The Hanscom complex includes the nonprofit MITRE Corporation with its scientific staff. MIT's Lincoln Laboratory, with its scientific competence specialized in the electronics sciences, is a separate agency but supports the complex in some of its work. Also located at Hanscom are the Cambridge Research Laboratories which are a part of the Research Division of ARDC. They also support the complex—and the Air Force in general—with basic research.

The Winter Study Group strongly endorsed the initiation of the Hanscom complex. In consonance with the Winter Study Group recommendations the Air Force is developing the procedures and is providing the resources to enhance the Hanscom complex:

- As a single, strong, central planning and analysis activity;
- With full responsibility and authority for making command and control systems design decisions;
- With a strong development activity;
- With a responsibility to provide continuous consultant help to operating commanders;
- And, charged to ensure that contractors are provided with realistic objectives, requirements, design parameters, cost data, and assistance.—END

STRATEGY IN PEACE AND WAR

C. W. Halligan

PRESIDENT, THE MITRE CORPORATION

Mr. Halligan joined The MITRE Corporation in 1958 after a distinguished thirty-two-year engineering career in the fields of commercial and military communications and weapon system development with American Telephone and Telegraph, Western Electric, and Bell Telephone. He was Bell Director of Military Engineering from 1951 to 1958.

IN MANY ways our weapons technology has outrun our command and control technology. The speed and power of our weapons will be of little use if our reaction time is too long. We have developed a new art for weapons, and we must match it with a new art for command and control. We must discard the classical concepts and invent new ones.

The problems will be complex in a technical sense, but may be even more complex in a management sense. Their solution will require technical capabilities of the highest order. The effort must be centralized and continuous. It must make full use of the technical resources of the military and of industry. Above all, it must be objective and must not be inhibited by tradition.

MITRE's job is to give the Hanscom complex this technical capability.

One of our activities is the conceptual planning which will establish the basic design principles for command and control systems. It will deal with strategy, what is needed for peace and what must survive for various kinds of war. It will define the broad command and control requirements for the elements within a command, for the coordination of these elements, and for communication between commands and to higher commands. It will determine the relationships between command and control systems and the proper balance between them. In short, it will provide the on-going philosophy under which these systems are conceived. It is usually called a long-term effort, and it is indeed a continuing, evolving effort. But it must also be applied to existing and near-term systems to the extent possible.

This conceptual planning will require the combined efforts of MITRE, CCDD, the operating commands, and other agencies. The output will be valuable for industry's planning, and should be made available to industry on a continuing basis. Industry's criticisms and suggestions will be valuable to the planners, and means for eliciting such criticisms and suggestions will be provided. We will need all the help we can get from industry to do this job well, and industry will need to know and understand this work.

Another of MITRE's principal activities is that of intersystem design. This considers questions of functional and technical compatibility among systems; common use of techniques and facilities; elimination of duplication; standardization of components, and, in fact, all of the interfaces that are so likely to be overlooked by individual system designers. This work must deal with systems in being, and systems yet to be designed. It should have the benefit of the views of the contractors for individual systems, and its results should be made available to industry. Intersystem considerations may limit the design latitude for individual systems, but if the contractors are kept fully and continuously informed, the benefits to them should far outweigh any disadvantage resulting from restrictions in choice of design.

Prospective contractors can assist us in basic planning of individual systems by comment and criticism and by presenting their own proposals for the system. They will benefit by being assured of an adequate specification for bidding, design, and manufacture.

There are some things that MITRE will *not* do. In general, we will *not* do the detailed design of specific systems. We will *not* manufacture them. We must do

(Continued on page 110)

High thrust production and instantaneous response of Hamilton Standard Hydromatics give Lockheed C-130B's exceptional STOL ability... unmatched flying ease and safety margins

With its advanced Allison T56 engines and Hamilton Standard Hydromatic propellers, the C-130B is creating impressive new standards of performance and operating efficiency which fit it for a vital role in the air-cargo era.

PROOF: It carries approximately 20 tons of cargo ... cruises at speeds up to 370 miles an hour ... has a maximum service ceiling of 40,000 feet ... and because of the high take-off thrust produced by its turboprop system, can use runways as short as 2000 feet. The system also provides extreme sensitivity to air-speed and power changes. Result: the C-130B offers outstanding flying ease and landing and take-off safety margins.

MANY OF THE SAME CRITERIA that make an advanced turboprop system ideal for the Hercules also make propellers the logical choice for hundreds of future military and commercial aircraft—far-ranging subsonic surveillance and attack aircraft ... VTOL and STOL assault transports and cargo carriers. In fact, wherever the mission need is maximum range, payload, or both, propeller systems will continue to be the most efficient propulsion method.

• • •

MORE NEW PROPELLERS are in development today at Hamilton Standard than ever before. Complete information on these programs is available. We welcome your inquiry.

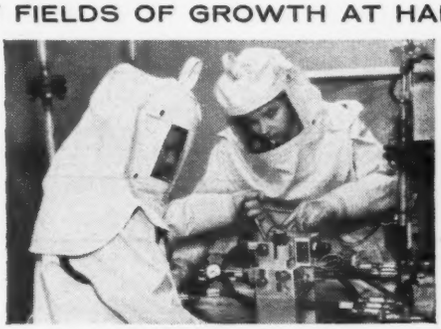
HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT

SOME OF THE MANY FIELDS OF GROWTH AT HAMILTON STANDARD

ENVIRONMENTAL CONDITIONING SYSTEMS for space vehicles and such advanced aircraft as the B-58, 880, B-70 are important aspects of Hamilton Standard diversification.



ENGINE CONTROLS for over 20,000 aircraft gas turbines have been produced by Hamilton Standard. The company's latest control work involves advanced rocket engines.

ELECTRONICS at Hamilton Standard includes broad experience in flight control, instrumentation, static power inversion and electrical control for aircraft, missile and GSE components.

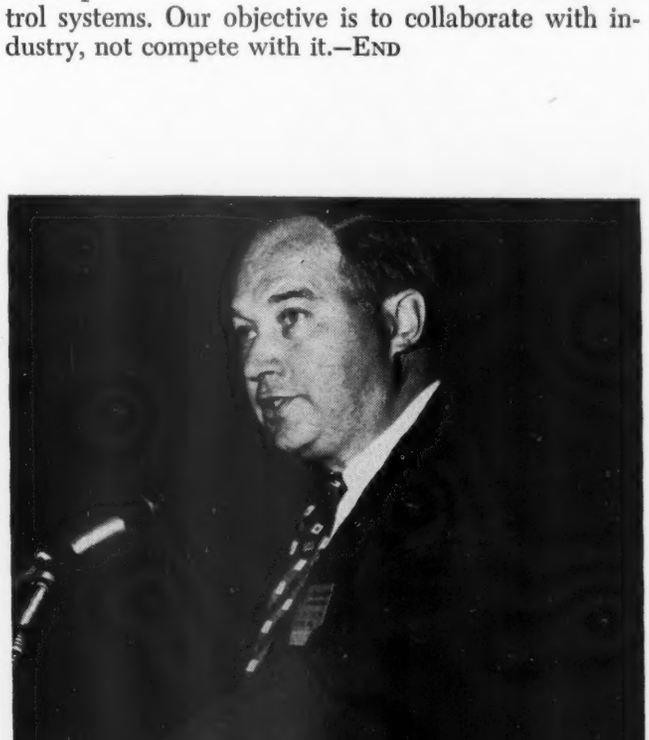
some development to support the activities but we will not do development for production.

MITRE is two years old. We employ a total of about 1,400 people which includes about 430 technical staff. This staff is organized into two separate groups, one for systems work and one for technology. The systems group will undertake conceptual planning, intersystem engineering, and the planning for specific systems. The technology group includes departments in specific areas, such as data processing, communication, radar systems, etc., and will support the general activities of the systems group. It will also engage in such fundamental development work as is required to make this support effective and to keep us fully informed of the state of the art.

Our work for CCDD is now our major mission, and this will be so as far into the future as one can see. However, our work prior to the formation of CCDD dealt with air defense—principally with SAGE—and for some years we will continue to devote a substantial, although decreasing, part of our technical effort to this area. We are assisting FAA and the Air Force, under an FAA contract in the integration of air traffic control and air defense. This effort accounts for about ten percent of our technical work. We have given some technical support to OSD and will probably continue to do so, but at a level which is likely to be about five percent of our total effort.

MITRE needs support and understanding from industry in order to do its job well. In return MITRE can and will help industry do a better job in the development and manufacture of command and control systems. Our objective is to collaborate with industry, not compete with it.—END

SPACE SHOTS, LONG SHOTS



Dr. Ivan A. Getting

PRESIDENT, AEROSPACE CORPORATION

Dr. Getting was named first president of the newly formed Aerospace Corporation earlier this year. He had previously been a professor of electrical engineering at the Massachusetts Institute of Technology and then a vice president of the Raytheon Corporation. During the second World War, he worked in a radar-development project.

TO MEET what General Ritland has described as "a frontier of infinite challenge" there is today in American industry an unprecedented capability, a reservoir of competence, of resourcefulness, and of experience in meeting bold challenges. There is within the government a level of technical and managerial know-how that is likewise without precedent throughout our nation's history.

Yet the challenge is vast, and it is aggravated by complexity, and by the need to extend the art and compress the time. Against real requirements, systems can be proposed even now whose cost can be measured easiest in terms of a new unit suggested by our colleagues at RAND—numbers of gross national products. In this environment of complexity, of manifold interfaces, of uncounted or unknown alternatives, a new order of sophistication has been required for synthesis in planning, for integration in conception, for coordination in implementation. New meanings and even greater significance are being given the now-familiar expression "systems engineering and technical direction" which was itself virtually unheard of or little understood a few years ago. A need has matured and has been recognized for a new kind of institution with a new kind of talent not readily available in proper form wholly within the military or wholly within industry.

This new talent must be fully developed and readily available for application to the new orders of problems ahead. It must be rigorously and diligently applied free of inhibitions or influences which might impair the objectivity of its results. It must be bred of unlimited conceptual scope out of broad experience, and it must be nurtured by continuing, art-leading research.

Aerospace Corporation was incorporated under the laws of the state of California in June as a nonprofit, private corporation to provide services that "are exclusively scientific: to engage in, assist, and contribute to the support of scientific activities and projects for, and to perform and engage in research, development, and advisory services to or for, the United States government." It has no stock, was capitalized by an advance payment pool of Air Force funds, is not chartered to do manufacturing, and its activities are guided by a distinguished board of trustees.

The Secretary of the Air Force has stated, "The Air Force looks to Aerospace Corporation as a major resource in the accomplishment of the Air Force ballistic missile and space programs. . . . The corporation has as its mission for the Air Force the field of ballistic missiles and space programs. Within this complete area, it has the responsibility for advanced systems analysis, research and experimentation, and initial systems engineering. It will also exercise such general technical supervision of ballistic missile systems as is appropriate. In special cases, and with the consent of the Secretary of the Air Force, Aerospace may assume broader responsibility for an Air Force military system. . . ."

While preserving corporate identity for Aerospace, and its independence of management in its close collaboration with the AFBMD, the nature of its interaction with industry will vary depending on the character of the task. Industry must continue to bear the brunt of the load, the maximum of responsibility and management, and the greatest extent possible of initiative. Reduced to its utmost simplicity the Aerospace-industry relationship can be described in three phases: (1) advanced planning and systems research; (2) initial systems engineering and initial technical direction; and (3) technical supervision.

In advanced planning and systems research, Aerospace will apply all the scientific and analytical skills at its command to do forward planning in collaboration with all appropriate elements of the Air Force including Air Staff, ARDC, operating commands which have needs for ballistic missiles and satellites such as the Strategic Air Command, and with such groups as The RAND Corporation, MITRE Corporation, and System Development Corporation. The objective of this effort will be to assist the Air Force in the formulation of new weapon systems concepts and in the preparation of specifications. In the performance of this task, Aerospace will necessarily make full use of concepts and ideas originating from any source. Aerospace will also assist the Air Force in the evaluation of both solicited and unsolicited technical proposals.

Once a funded weapon system has been established and a contract with industry determined, Aerospace will provide initial systems engineering and initial technical direction and over-all integration with other systems. In the rapid advance of science and with the changing military situation, weapon systems can become obsolete even during the period of prototype engineering and test. The systems engineering and initial technical direction function should go a long way to diminish such waste. This is one of their prime functions.

As a weapon system matures, and it becomes clear that the technical realization is indeed a solution to a military need, Aerospace detailed systems engineering and technical direction can and should be relaxed. Aerospace Corporation will then assume the less tightly coupled role of technical supervision. During this stage, industry will be responsible for all its normal functions including detailed systems engineering and technical direction of subcontractors. However, technical modifications of the system will inevitably arise and these must be reviewed to make sure that such changes will not affect the military worth of the weapon system or jeopardize the technical performance.

The above functions will be performed by two of the three technical divisions of Aerospace, appropriately called: the Systems Research and Planning Division and the Engineering Division. These will be supported by a Laboratories Division. The Laboratories Division will have an additional function of performing art-leading research. This separately identifiable responsibility of Aerospace Corporation is an essential ingredient to success. We cannot do lip service to our race with Russia in the scientific fields and lean back complacently awaiting results. We must in point of fact get down to the bench and do some hard work.

Aerospace as a research organization must participate in the community of university and industrial

(Continued on page 113)

Revolutionary RCA Magnetic Video Tape Recorder to Speed Navigation Training of Submariners

Aboard the nuclear submarine Sea Dragon, the first undersea magnetic video tape recorder will record and store data on under-the-ice characteristics from externally installed TV cameras. Upon return to base the recorded information will be displayed for the benefit of undersea service trainees.

The RCA undersea recorder is a marvel of compact design (dimensions 20" x 20" x 100"). It nestles in a torpedo rack, and represents a 60% space reduction over existing video tape equipment.

Among the exclusive RCA developments are: the now famous "Tiros" satellite recorder; a radar system designed to take the first pictures of a nose cone re-entry vehicle; a unique tape cartridge completely adaptable to any size recorder. For literature describing new RCA defense and commercial products developments, write Defense Electronic Products, Radio Corporation of America, Camden, N. J.

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research. Universities on their part will tend to pursue those areas of scientific interest most challenging to them and most satisfying from the standpoint of yielding to interesting solution. Industry on its part will direct its attention to some reasonable expectancy of a return on its investment. To Aerospace will fall the role of doing such research as is necessary to make sure that any potential enemy will not find us lacking. In part, this means that we must emphasize the difficult and sometimes the long shots. We must be prepared sometimes to fail, sometimes to have no results, and sometimes to show no return on the investment.

If I may again quote Secretary Sharp: "Essentially, this corporation will be people—people of the highest quality. The United States Air Force recognizes that men of great scientific and technical competence can perform at their best only when they can exercise their initiative to the full under leadership which creates the climate for creativity. We expect Aerospace Corporation to provide that kind of environment."—END

CHANGES, CHALLENGES, AND CHECKBOOKS

Lt. Gen. William F. McKee, USAF

VICE COMMANDER, AIR MATERIEL COMMAND

General McKee, prior to assuming his present duties as Vice Commander, AMC, in 1959, served as Assistant Vice Chief of Staff and Assistant Deputy Chief of Staff for Administration. He had, earlier, been Commander, Headquarters Command, USAFE, and Chief of Staff of the Air Transport Command.

LAST September, you may recall, I stressed that both the Air Force and industry were facing an extremely tough challenge in the control of weapon system costs. We were deeply concerned about the problems of pricing and contract management, espe-

(Continued on following page)

cially at the subcontract and vendor levels. We discussed the specific actions needed to improve both Air Force and contractor competence in getting maximum weapon system value with the resources available to us.

While much progress has been made in the past year, the fundamental problem is still with us and remains acute.

Many reports from various sources indicate clearly that we have only begun to resolve the many problems connected with contracting for and pricing of our present sophisticated aerospace systems. A tremendous amount of work yet remains to be done—work which will demand the utmost in mutual understanding, imagination, and initiative on the part of all levels of management of both the Air Force and industry. You can expect an intensification on the part of the top levels of the Air Force which will reduce costs significantly below the present levels. Unless we are successful, we can expect a sharp curtailment in many of our programs.

The forces of change that have intensified our contracting and pricing problems have, of course, had a far-reaching impact upon many other aspects of our logistic mission. In AMC, for example, we have closed some forty-one depot-level logistic-type facilities throughout the world over the past several years. During this same period we have reduced our manpower spaces by a total of more than 53,000, cut our Headquarters staff by fifty-six percent. Industry, too, has faced major readjustments of facilities, workloads, and manpower—and must be prepared, as we are, for still further changes in dynamic response to evolving defense necessities.

In the short period of ten years the concept of warfare has changed from what we might call a *quantitative* to a *qualitative* emphasis. During the war years, AMC, as the logistic arm of the Air Force, had to gear itself to procure, supply, transport, and maintain large quantities of relatively low-cost materiel for many bases of operation throughout the world.

Today we still perform that same basic mission. However, the variety of materiel we deal with has greatly increased. The pattern of usage is markedly different. Unit costs have soared. And time has become an ever more critical factor. These changes have had a profound impact upon our patterns of organizing and accomplishing our mission.

Major advances are being made concurrently in the area of supersonic manned aircraft, guided missiles and rockets, ballistic missiles, space vehicles, and ground electronic systems. Each of these weapon types has peculiar logistic support requirements; yet all must be dealt with concurrently. The transition from large-scale production of relatively low-cost items to limited production of varied species of costly, sophisticated weapons has affected many facets of the internal functioning of Air Materiel Command. Moreover, it has had, and will continue to have, a profound influence upon industry.

In the case of manned aircraft, for example, the initial job of AMC is to acquire and deliver an operational system to the using command. Thereafter, adequate supply and maintenance services must be provided to keep the manned system operational during its service life. This involves one set of problems for AMC. The using command itself assures that the basic facilities to accommodate the system during its operational life are available.

By contrast, a missile in the hands of the using command is of little value by itself. The operational capability of a missile is peculiarly dependent upon a tailored environment which, for all practical purposes, is an integral part of the weapon. This creates an entirely new set of logistic support problems. The technical complexities of ground support are such that the job of making ready for the delivery and use of any particular weapon can no longer be left to the using command.

AMC has reorganized in partial response to the challenge of these and other problems incident to supporting advanced weapon systems coming into the inventory.

We now have, for example, three major procurement centers each of which concentrates on a homogenous grouping of weapon support systems. This permits the specialization of effort necessary to provide custom-tailored support for the greater variety of weapons. The latest member of our buying team is the AMC Electronic Systems Center at Hanscom Field, Bedford, Mass.

A modern weapon is an assemblage of thousands of intricate components. Both major components, and materials and processes required to produce an advanced weapon, are the results of specialized research and development. Research on the varied elements involved progresses at varying rates—always, of course, pushed along as rapidly as possible.

We have had considerable success to date in synchronizing such development. However, on a number of occasions, we have met with serious delays in the timely production of a weapon for want of smaller—though functionally important—components. Therefore, to minimize delays in the production of new weapons, it is necessary to determine at the earliest possible moment the items of materiel for which production problems are anticipated.

Finally, although the broad and basic logistic mission remains constant, we must also have a built-in capability for absorbing and integrating new responsibilities as the nature of our advancing technology makes this necessary. The essential precise integration of missiles with their complex ground environments has now drawn Air Materiel Command into the business of site activation, installation, and checkout. In this regard we should realize that site activation is really an extension into the field of factory production.

These are all aspects of dynamic logistics for aerospace power. They typify the continuous, concentrated effort which not only the Air Force, but industry as well, must make to keep our logistic management in firm and creative control of the new weapon systems. Only so can we realize their full potential for our national defense.—END

'GUESSTIMATES' WENT THAT-A-WAY

Maj. Gen. Waymond A. Davis, USAF
COMMANDER, AMC AERONAUTICAL SYSTEMS CENTER

General Davis, assigned to his current post as Commander, Aeronautical Systems Center, AMC, earlier this year, previously was Deputy Director of Procurement and Production at Air Force Headquarters and Deputy Director, Weapon Systems, Directorate of Procurement and Production, of the Air Materiel Command.

THE AWESOME technological advances made in the past few years have outstripped and rendered inadequate our old decision-making techniques. Good systems management now requires a continuing revision and updating of controls and techniques that will ensure the right decisions.

In addition to keeping pace with the state of the art, the present-day Air Force logistic program manager is faced with a whole new philosophy of warfare, evolved with the atomic era, which causes him to look at logistic management and materiel support in an entirely new vein.

The concept of deterrence requires sober and soul-searching contemplation on his part. He must now face the fact that there will be a reduced number of types of instruments of combat in our future inventory and that the quantities produced of these types will be small in number. The need for the massive support efforts which characterized the past decades no longer exists. Although the total number of systems in the inventory will be reduced, the modern system and its components is overwhelmingly complex. It represents staggering costs which render insignificant the dollars expended for the vast armadas of weapons produced during and after World War II.

Over-all, this means that production programs themselves will be of relatively short duration, will involve tremendous sums of money, and will constitute a considerable impact on the nation's economy.

In order to reduce this effect to a minimum, the logistic manager must make his basic decisions *prior* to the issuance of a system program directive. The acquisition time and dollar requirements for the system and its components do not allow the old leisurely pace of action common to the massive production effort. We can no longer afford after-the-fact "guesstimates" of resources and costs; incomplete and inadequate conceptual plans; a "tuning up" of production facilities, etc.

In these troubled times, when opposing ideologies struggle for supremacy, fear and uncertainty seem to pervade the world atmosphere. Only faith and confidence can destroy these specters. With this in mind, the Air Force has developed a philosophy that can best be described as "a look to the future." Its simple premise is that careful and aggressive study persistently directed toward tomorrow's goals will produce tomorrow's superior weapons. It requires that a tremendous emphasis be placed on studying and analyzing all the available data from basic research, industry, educational institutions, intelligence, the Air Force, etc., and projecting these data into possible systems requirements of the future.

A careful evaluation and analysis is then made of the potential system in much the same light as though it represented an actual operational need. This evaluation continues on an expansive basis until the time is reached when the Air Force must determine if it is a bona fide requirement. Ultimately then, the total program needs—concepts, plans, agreements, future budget estimate plans, dollars required, resources, etc.—are developed and *on hand* at the time the development directive for a system is received. Obviously, in order to meet these needs, the system logistic manager must have made his decisions during the advanced system study phase of the program.

You are probably wondering what caused the Air Force to adopt the "new look." There are many reasons: international competition in the R&D area, the aforementioned concept of preparedness, and just plain, old-fashioned "horse sense" prompted the Air Force to

(Continued on page 118)

AT-THE-READY MISSILE SITE SUPPORT

WITH THE VERTOL 107

The Vertol 107, twin-turbine-powered helicopter, offers a new concept of dependability for all-weather, around-the-clock support of ICBM dispersed launching sites.

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The twin-turbine, tandem rotor Vertol 107—the most advanced helicopter flying today—offers a new high in dependability for the Strategic Air Command.

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review its way of doing business. From the viewpoint of ASC, however, there are three specific reasons for taking a new look which I believe are important enough to enumerate here.

First: Existing programs are a constant reminder of the past deficiencies in planning and decision-making. Too many of the current production and materiel support programs were initiated on the basis of overly optimistic estimates of time and costs, which were made on a crash basis without adequate background study. Many of the deficiencies of current systems are due to not having fully evaluated the producibility of a system or accurately estimated resources and materiel support requirements *prior* to the time that an operational requirement was issued. In many instances, however, to continue these programs drastic recent programing action has been necessary, which results in reductions or delays and sometimes an impact, fundwise, on other programs.

Second: Programs have been terminated after millions were spent without proportionately improving or increasing the Air Force's capability. Here again, more aggressive analysis, study, and fact gathering at the proper time might have resulted in earlier and, therefore, less positive decisions.

Third: It has become increasingly apparent that technical feasibility alone cannot be the only factor in determining whether a new system is practicable. Producibility and materiel support capability must be considered from the time that a potential system is a "gleam-in-the-eye" study requirement. Future systems management must be based on this concept.

Because of our close relationship, the recent reorganization of WADD, emphasizing the advanced system planning, has naturally had an impact on ASC. The newly created Directorate of Advanced Systems Technology represents an excellent accumulation of engineering know-how which WADD is using to probe technical possibilities of the advanced systems areas. The combined efforts of this directorate with those of Systems Engineering and Systems Management result in a WADD capability to do the necessary planning both from an operational and management standpoint that will ensure a successful R&D effort in keeping with the state of the art.

Because all actions taken by WADD have a direct effect on us, we in ASC have also recognized our responsibilities in this area and, in looking to the future, have realigned some of our organizations and concepts of operations to ensure better management. We have expanded our relationship with WADD and have effected some organizational and functional changes which will be of interest to many of you.

Two divisions have recently been established within the Directorate of Production whose sole purpose is to work in close harmony with WADD in evaluating advanced developments under way within WADD. These organizations—the Plans and Programs Office and the Advanced Systems Division—represent a regrouping of some of our top talent from the production and materiel support areas. These organizations will develop concepts and plans for participation in the advanced systems programs and studies and will determine the logistics feasibility of the individual advanced systems under study by WADD.

They will provide a continuing capability in the area of forecasting and evaluating advanced developments and, basically, will look at the materiel implications and significance of these developments, covering the factors of time, cost, and logistics feasibility. To do this, these organizations will devise a system of materiel programing for advanced systems plans and will prepare materiel program plans for final Air Force decisions. They will also provide inputs to existing advanced systems plans and programs.

Some of their specific functions are to:

- Determine if it is feasible to plan production of a new system within known existing or obtainable capabilities of the industry within the time required.
- Estimate research, development, production, and maintenance costs to determine if the total cost can be supported from planned appropriations considering priority of all other systems being considered.
- Ensure that the state of the art for manufacturing processes to refine, machine, weld, or otherwise assemble new and exotic materials will be available in the time period planned for production of a new system.
- Evaluate our current maintenance concepts against planned maintenance requirements for new systems to ensure that maximum reliability is achieved.
- Carefully examine the requirements for ground support equipment, spares and spare parts, our methods of warehousing, transportation, and computing support requirements, and establish a definite plan for materiel support of any new system being considered.
- Act as the focal point for industry.
- Prepare forecasts of trends and accomplishments in evaluating advanced systems.
- Provide dollar impact information to Headquarters USAF to assist in determining the feasibility of initiating a new system requirement.

Time and cost are the demanding and controlling factors of our "new look." Time cannot be bought. It is earned. We start to earn it when we determine cost estimates, resource and facility requirements, concepts, plans, and producibility estimates during the study requirement stage. The nucleus of data accumulated during this period is massaged and expanded on a continuing basis. It grows not unlike a snowball through periods of accomplishing detailed fits on the Required Development Objectives (RDOs), the System Development Requirements (SDRs), and eventually the Specific Operational Requirements (SORs).

At this point, the over-all program will be sufficiently refined and comprehensive to determine if the over-all cost is prohibitive or within the budget dollar ceiling. By the time the program directive is issued, a complete packaged program has been developed. The Air Force can proceed with enthusiasm and surety in such a program, confident that its choice has been a wise one, confident that the program is economically sound, and confident that its "look to the future" is paying dividends.—END

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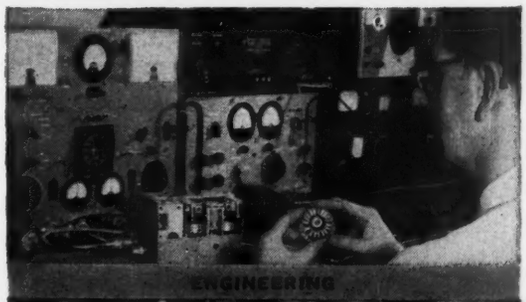
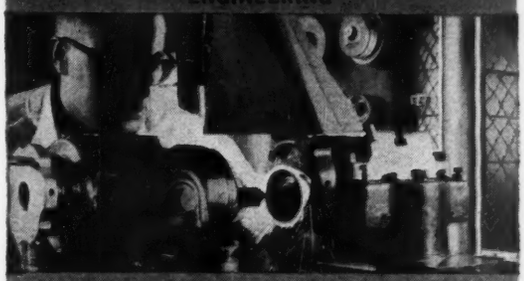


ENGINEERING



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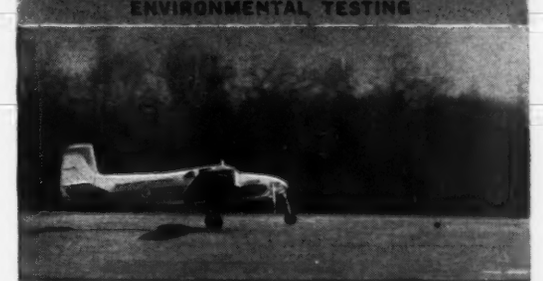

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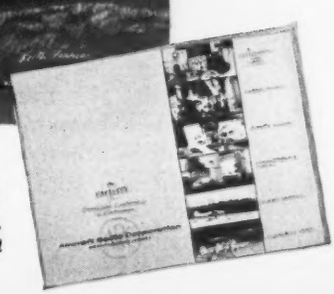

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MISSION: GET RESULTS

Maj. Gen. Clyde H. Mitchell, USAF

COMMANDER, AMC ELECTRONIC SYSTEMS CENTER

General Mitchell, who assumed his duties as Commander, Electronic Systems Center, AMC, earlier this year, was previously Commander, Rome Air Force Depot, Griffiss AFB, N. Y., and Special Assistant to the Director of Procurement and Production, AMC. He also served in key AMC posts during the second World War.

CHANGES in the organizational structure within the Air Materiel Command are brought about for two basic reasons; one, to keep pace with new rapidly advancing technology, and the other, to be compatible with the organizational structure of the rest of the Air Force as it evolves in light of new weapons and new problems. Both rapid technological advance and changing organizational structure within the Air Research and Development Command plus increased recognition of the importance of electronic systems led to the formation of the Air Materiel Command Electronic Systems Center.

AMC had recognized the need to approach the acquisition and installation of major electronic systems through the system project office technique when it participated in the formation of project offices in New York City for the Distant Early Warning Line and the Semi-Automatic Ground Environment. As additional systems became urgent and the realization of the advantages of maximum intersystem considerations became obvious, we moved into the posture of a separate center to work closely with ARDC's Command and Control Development Division in carrying out our AMC responsibilities. It should be recognized that both the Air Materiel Command's Electronic Systems Center and the Command and Control Development Division of the Air Research and Development Command are coequal and mutually supporting and this status best evidences itself in our joint project offices which are commonly referred to as ESSPOs or Electronic Support Systems Project Offices. In the future, all such offices at all three Centers will be called Systems Program Offices to emphasize the broad scope of their responsibilities.

The full realization of the importance of the electronic command and control type systems and the need for a fully specialized organization to carry out their implementation is just now becoming fully appreciated.

The organization of the Electronic Systems Center during the last year is concrete evidence of the Air Materiel Command's recognition of the dynamic nature of our country and the logistics mission of the Air Materiel Command. The steps taken to bring about an Electronic Systems Center are ample evidence of the dynamism of AMC's approach to the changing problems it faces.

Our ultimate objective at the Electronic Systems Center is to produce a unified and compatible ground electronic environment to serve all aerospace forces.

Or, to put this point another way, the effectiveness of the entire Air Force operation is directly related to the effectiveness of our command and control systems. This is not to say that the tail wags the dog. Command and control systems are support systems. But a dog without eyes, ears, and a nervous system is not much of a dog.

This places upon us at the Electronic Systems Cen-

ter and our counterparts at ARDC's Command and Control Development Division, the responsibility for designing, installing, and delivering command and control systems for air defense, for strategic retaliation, for miscellaneous support operations—for an all-out war or a local conflict. We are concerned with the air-breathing threat, the missile threat, the challenge of space, and the challenge of time.

Weapon systems management means different things to different people. Generally speaking, industry interprets weapon systems management to mean the placing of extensive responsibility with a single industrial firm so they can best harness the talents, facilities, and capabilities of the total industrial spectrum in the producing of a combat weapon but at the same time clearly placing over-all responsibility at a single point or under a single management head.

In the Air Force we have combined the concepts of weapon systems management and concurrency to evolve a philosophy of management which can well be called systems management without any reference to weapon systems or support systems as such. Under this philosophy, progress is achieved through bringing together functional organizations containing specialists in development, logistics, operation, and training plus representatives of other contributing organizations so that their composite of capability and responsibilities can be carried out simultaneously and in concert to give us a weapon at the earliest possible date.

As evolved over the years, first at Wright Field, then in Inglewood, the system program office has become a major tool of Air Force management. It is the office responsible for results. The Chief of the program office, now called the Program Director, will be an ARDC officer when the project is predominantly development and changed to an AMC officer after initial operating capability is assured. The Director is the link between the Air Force and industry. He is also the one man to whom all of the Air Force looks for progress and accomplishment.

Systems management as practiced through system program offices has first been referred to above as a technique or tool. All of our weapon and support systems differ to some degree. Our electronic support systems are generally peculiar in that they are one of a kind or evolutionary and the prototype might well become the first or only operational facility. These facts, and also the fact that even two electronic systems are not similar, require flexibility and dynamism in application of the program office technique.

In addition to managing the development and acquisition of individual electronic support systems, we have a side benefit which comes through programing and planning above the single system level which gives us a well balanced and compatible total program. This intersystem planning is extended to the point where the Electronic Systems Center is the Air Materiel Command's executive agent in assuring compatibility between airborne and ground electronics, assuring the availability of the required ground electronic environment, and providing maximum support to the Aeronautical Systems Center and the Ballistic Missiles Center in this way. This means that within the AMC functions of procurement, production, installation, and the schedules associated with these functions, we must assure timely and adequate support to all weapon systems.

An important point about our mission is that we deal in complete systems. We are not AMC's agency for the procurement of individual ground electronic equipments or components. That has been and is now the responsibility of the Rome Air Materiel Area. Also, the Electronic Systems Center joins AMC's Aeronautical Systems Center and Ballistic Missiles Center as an organization authorized to report directly to Headquarters AMC and to call upon the support of other AMC agencies. Third, we will continue to use, wherever practical, the Rome Air Materiel Area and the Ground Electronic Engineering Installation Agency. These two AMC organizations deal in the procurement and installation of electronic equipments at less than the system level. Where it appears preferable to use government furnished equipment, as opposed to contractor furnished items, we will go to Rome for them.

A continuing big problem in the Air Force is that of determining the best possible utilization of our manpower and our weapons power. Our key policy and planning decisions in regard to this problem are, in final analysis, efforts in predicting technological advances and the enemy's intentions. When the potential enemy is a Communist, the problem is particularly difficult.

We, at the Hanscom complex, believe the difficult situation, or the almost impossible task of predicting the action of the enemy makes command and control systems essential to our national defense. Since we cannot accurately predict the enemy's intention, we have to be dependent upon the alerts we will receive from the electronic intelligence and early-warning systems, and then on our ability to use this information in controlling our forces.

New organizational and management concepts do not come about easily. You are faced with vested interests of established groups and inertia associated with past methods. Once you have conceived such an organization and its broad aspects, organizational planning must be detailed out so that recruiting of people can begin. After you have a reasonable percentage of your people aboard, you start evolving and clarifying procedures and techniques under which you will operate. Then comes the big problem of getting everybody acquainted with what you intend to do and how you intend to do it and the second problem associated with getting everybody to agree and to understand the management approach being applied.

We have completed most of these steps at Hanscom Field. We have ninety percent of our people in place and we are fully capable of carrying out AMC's responsibilities of assuring that production, installation, and available supply and maintenance support will not be the controlling factor in making new weapons and techniques available to our combat forces. Technological capability must never be hampered by logistic inadequacies.—END

(Continued on page 124)

HEDGEHOPPING AT MACH 1
Lockheed radar shows pilot how to miss what he can't see

When a pilot hugs the deck traveling a mile *every four seconds,* his route is the world's most dangerous obstacle course. Hills, bridges and other hazards can be in his lap before he has time to maneuver safely over them. He needs information well in advance, particularly in poor visibility or at night.

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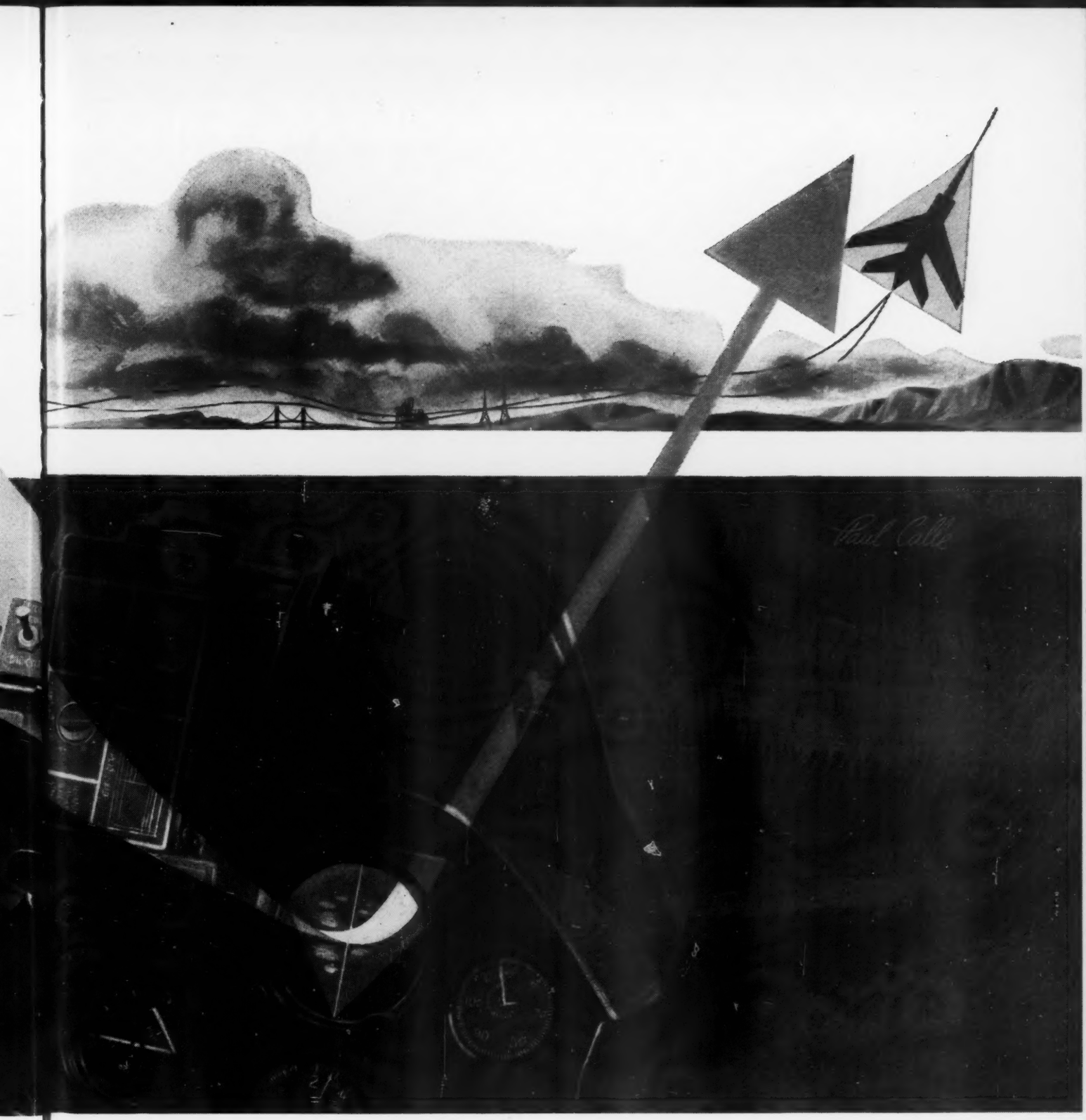
UNDERSEA WEAPON CONTROL AND DETECTION—ASW, electromagnetic detection, location and communication

SIMULATION AND TRAINING DEVICES

OPERATIONS ANALYSIS—offensive and defensive systems, war operations, undersea warfare, electronics in space



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USAF's 10,000-MILE PRODUCTION LINE

Maj. Gen. Thomas P. Gerrity, USAF

COMMANDER, AMC BALLISTIC MISSILES CENTER

General Gerrity, appointed Commander of AMC's Ballistic Missiles Center earlier in 1960, had been Director of Procurement and Production at Air Force Headquarters and Commander, Oklahoma City Air Materiel Area. After service in Pacific fighting, he was assigned to AMC in 1942, has held several major procurement posts since.

OUR JOB, at the Ballistic Missiles Center, is that of procurement, production, and logistic planning of present and future ballistic missiles and space and satellite vehicles. In addition, we are responsible for the successful activation and turnover, to the Strategic Air Command, of designated ballistic missile sites in an operational condition. It is this new and most urgent requirement that I want to discuss.

The obtaining of operational ballistic missile sites, on schedule or ahead of schedule, is a matter of utmost importance to the security of our country. Even a small slip in schedule, or the delay in delivery of one piece of hardware will compromise our ability to meet this goal.

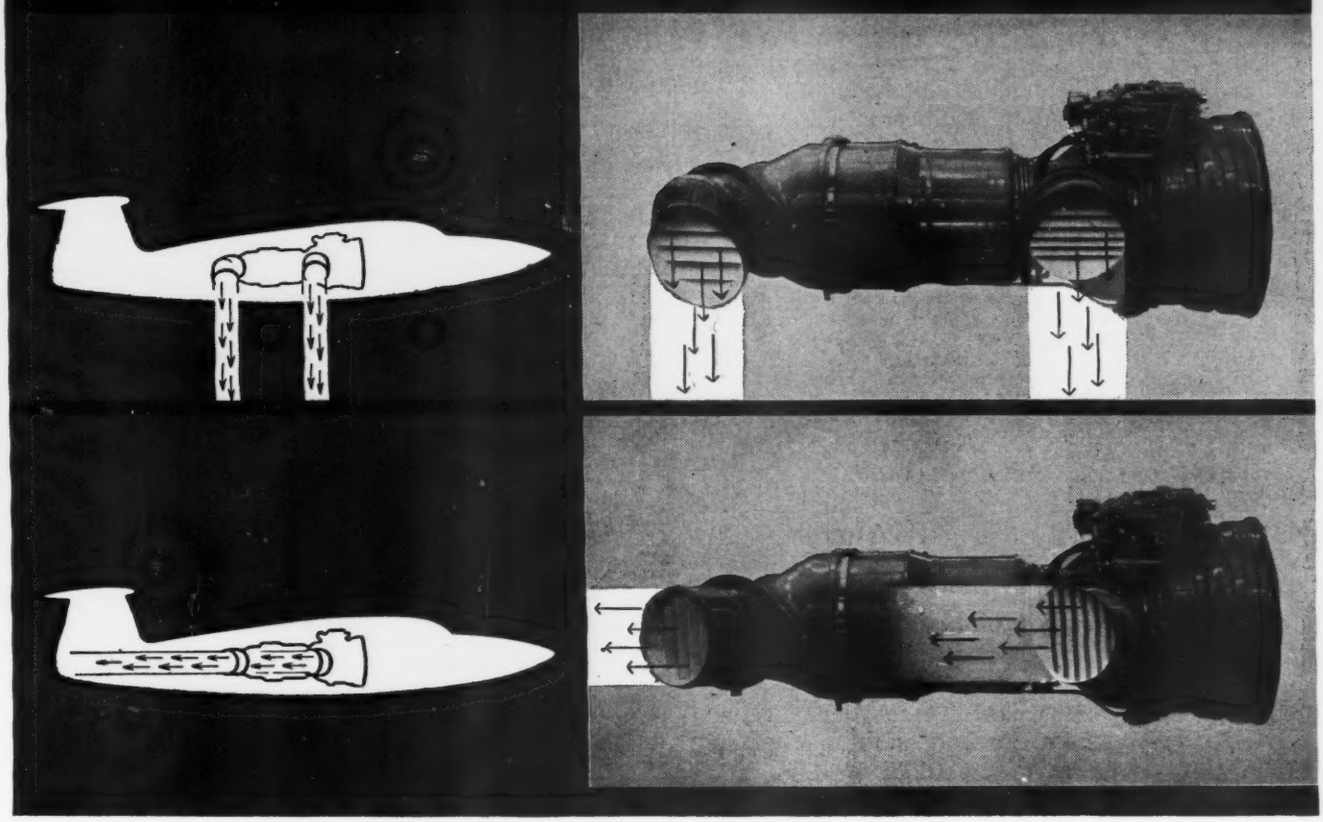
Site activation, in a broad sense, is the over-all production responsibility of the ballistic missiles program. This includes the production efforts of the vendors and subcontractors and the associate contractors at their plants throughout the United States, as well as the construction, installation, checkout, and delivery of operational missile systems at the sites. I call it a 10,000-mile production line, which runs from Boston to Seattle for contractors, and from Plattsburgh to Spokane for sites.

Many of the basic problems which we are having today are not too different from the problems we faced when we built the B-29 during World War II. While we used the principle of concurrency in the B-29 program, it was not as well organized and defined as in the ballistic missile program. We had a tough job getting initial production on the B-29. But we overcame the hurdles and compressed the development-to-production cycle into a short time span, enabling the B-29 to play a major role in winning the war in the Pacific.

Today, in the ballistic missiles program, these basic

(Continued on page 126)

LIFT and THRUST from ONE ENGINE— the Revolutionary BS 53 Turbofan



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The Bristol Siddeley BS 53 has already been selected for the Hawker P 1127 VTOL light strike fighter and is supported by the Mutual Weapons Development Programme for NATO.

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problems have increased tremendously. This increase is due to the high performance demands, the complexity of equipment, and the essentiality of reliability. In addition, the 10,000-mile production line, which is an extension of the factory into the field, demands far more precise planning and scheduling.

The large work force required, superimposed on quiet rural and small town communities, results in problems of housing, transportation, entertainment, medical care, and others that in some cases are serious. The marriage of precision equipment with a heavy concrete and steel structure so that the two will work as a single unit has caused problems that were largely unpredicted. The numbers and types of people required on site have exceeded our expectations by as many as five times. If there is anything that characterizes our site activation experience to date it would be "underestimation of the job." What once was considered a relatively simple job of hooking together a few pieces of equipment and pushing the button to see that it worked has turned into something of a monster. We can lick this monster if we reorganize and respect it for what it is and gear our effort accordingly.

Each base has a different management team, and each team has different workers. The problem is—how do we establish an effective learning curve under these circumstances? In the factory one management-production team learns by performing repetitiously the same operation on succeeding production units. Because of compressed schedules in the site activation program, little opportunity exists to move management and workers from site to site and establish a learning curve in this manner. Other methods must be developed to transfer know-how gained on earlier bases to those sites to be activated at a later date. I might suggest a few:

First: Specifications and production data must be very clear and precise, to prevent costly and time-consuming misinterpretations. There must be a continuous and well coordinated team effort between the designer and the producer.

Second: We must have strict discipline in configuration control. We cannot afford to jeopardize completion of hardware and installation of subsystems by too many late changes.

Third: We must simplify the work in the field through maximum prefab and validation of components in the factory. This will not only reduce the effort in the expensive field environment but will also take maximum advantage of the learning curve benefits inherent in a factory production line.

Fourth: We must have industrial engineering analysis of methods, processes, and procedures at early sites with recommended improvements passed on through a rapid, accurate communications system.

Fifth: We must have itinerant crews of specialists to perform the more complicated, short-term tasks. This may have the added advantage of cutting short term peaks off the field manpower loading curves.

To help solve the learning curve problem in the field we must place some of our best managers and workers at the sites. Also we must instill in these people the understanding and motivation which they need to recognize the importance and urgency of their mission, that of completing the job. The team must also be thoroughly indoctrinated in the need for quality and precision of workmanship to ensure delivery of a reliable product to the customer.

We cannot afford to have second-rate managers and workers in this task. We need managers who can solve difficult problems properly and in a timely manner. We have no room for people who worry unduly over subparagraphs in contracts, or about their "soft prerogatives."

There is another major problem which we must solve if we are to successfully complete this task—that is the problem of management-labor disputes which have resulted in costly delays to the program. These differences can be resolved without work stoppages through better understanding on the part of both management and labor of the many important facets of this task, as well as the paramount importance of timely completion of these missile bases in the interest of national defense.

I am sure that, if both labor and management would realize the full impact of work slowdowns and stoppages to the national defense effort, they would work much harder to iron out their difficulties. I want to make a personal appeal to management and labor to reexamine and strengthen their problem-solving methods. I am not here to take sides—unless you consider the interest of the American people as taking sides. Both labor and management are an important part of the whole nation—the American people I am dedicated to serve. If they pull together as a team I am confident we can do this task better and faster than anyone else, including the Soviets. If every effort is made to straighten out our difficulties at the conference table, we will be able to avoid delays in delivery and schedule, delays which are extremely costly in both time and money.

Speaking of costs, I am sure you all appreciate that this is a tremendously expensive program. Furthermore, it carries a priority and urgency that if not used judiciously, could easily push other important programs below the line for lack of money. We all have a grave responsibility to see that this doesn't happen. Strong management evidenced in sound, timely planning, strict discipline, close supervision, attention to detail and avoidance of a Cadillac when a Ford will do, is the only assurance that we can do this job without pushing other things out of the "buy" program. A large chunk of the nation's resources are going into this program. The people who are paying for it are justifiably intolerant of waste and inefficiency. Only alert, motivated management can prevent it.

The job is a tough one, though by no means impossible. But, in order to be successful, we must have a "tight" show, with clear-cut lines of responsibility. We must have good, direct communications among all members of the team on this 10,000-mile production line. We must have direct reporting channels, and we must delegate proper authority to the managers at the sites. We must recognize and solve problems at the

time of inception—and before they become major bottlenecks.

We have taken several management steps to expedite completion of our mission. The first of these was the selection of twelve senior Air Force colonels now in place at Atlas and Titan sites across the country; as new bases are activated, we are assigning additional senior officers. These colonels, who are called Site Activation Task Force Commanders—SATAFs for short—are in full command of all activities at their respective sites. They have one reporting channel, directly to me.

These SATAFs have a lot of help in their job at the various sites. While they are personally responsible for any and all management aspects of site activation, they have under their jurisdiction detachments from the Air Force Ballistic Missile Division, responsible for facility design and engineering; the San Bernardino Air Materiel Area, responsible for logistic support at the site; and the Western Contract Management Region, responsible for all phases of contract administration. They also work closely with the representatives of the US Army Corps of Engineers, who are in charge of all phases of construction work at the respective sites. In addition, major associate prime contractors, together with architectural and engineering contractors, have their work forces and technical representatives physically located on site. Finally, the officers of the Strategic Air Command, representing the eventual user of the operational weapon system, are working hand in hand with our site activation commanders toward early and successful site activation.

As I said before, management of our production line is complicated by its length of "10,000 miles." But, as production expediters, we cannot allow this complication to make us falter in our mission. We must have direct, continuous communications with all elements of the production line, on a twenty-four-hour-a-day basis, in order to expedite problem solutions and eliminate shortage. This communications system includes all military and industry members of our team.

We have initiated a complex of Command Control Posts, with the central element at Inglewood, and a command post at each separate missile site. As necessary, we will install similar command posts at contractor locations. Personnel manning command posts have full authority to direct appropriate action on any given problem.

My responsibility and authority to complete this task on schedule has been made abundantly clear. The responsibility and authority of the Air Force and industry managers at the sites has also been made abundantly clear. We have welded this group together as an effective team which can perform the mission.

There is one area where we are not able to guarantee progress to a predicted schedule that can seriously affect our site activation job. This factor is system development, including ground and flight test, the inevitable forerunner of any successful production show. Without a fast-moving development program culminating in an operable system defined by detailed specifications and manufacturing, assembly and checkout procedures, we are faced with a job shop operation wasteful of both time and money. The development effort must be pushed with all the resources and vigor that can be brought to bear. This is largely the responsibility of you in the aircraft industry.

We have had tough programs before and after considerable strain have hauled them out of the morass and put them on the shelf. American industry has faced many challenging tasks and has never failed to rise to the occasion.

If we pull together as a tightly knit team with a common understanding of our methods and objectives, we will make this show a success.—End

At Industry Seminar event of 1960 AFA National Convention. MIT's Dr. Valley, ARDC's General Schriever, CCDD's General Bergquist, MITRE Corporation's C. W. Halligan, BMD's General Ritland, Aerospace Corporation's Dr. Getting.

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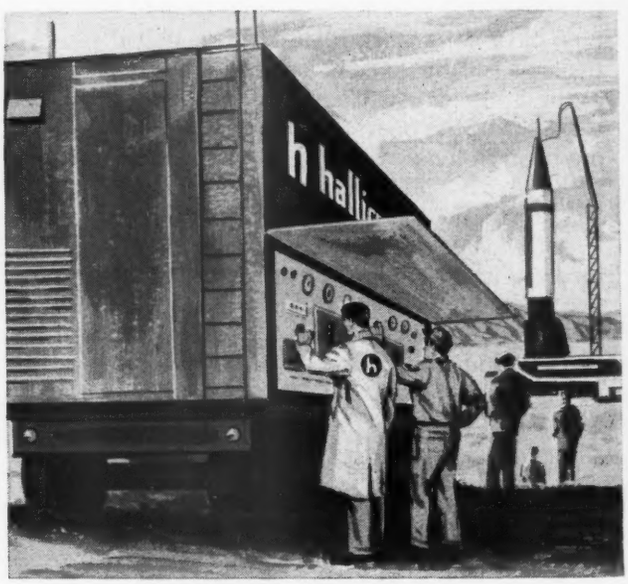

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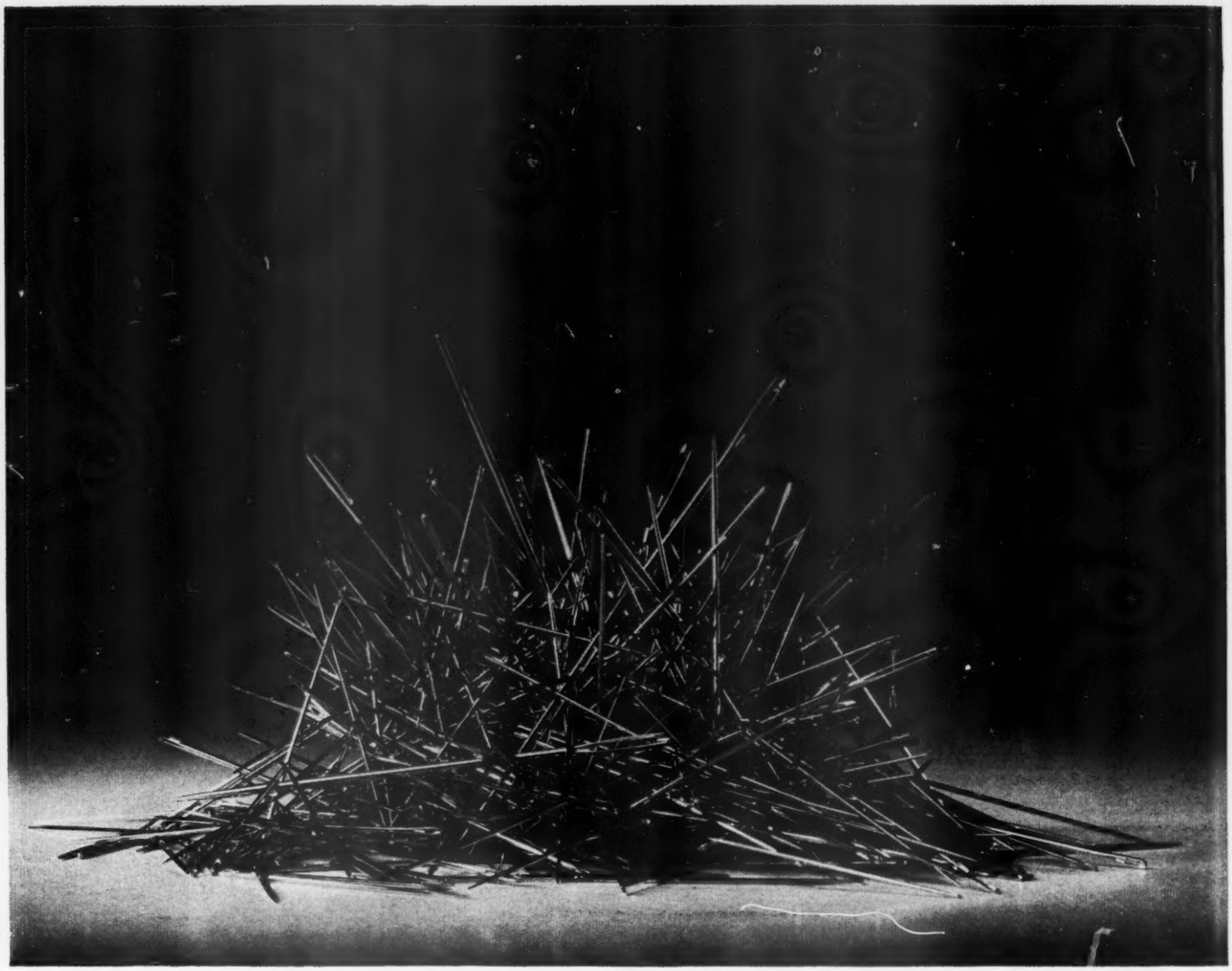

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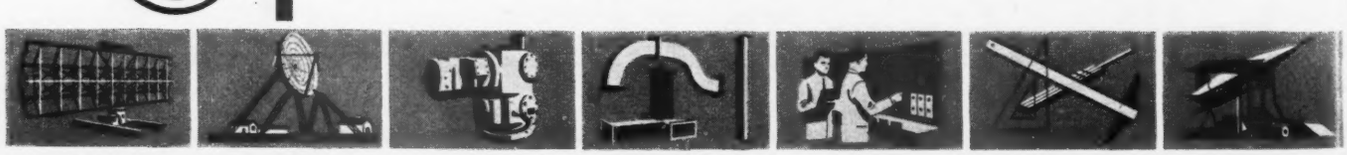

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the Ready Room

RESERVE AND AIR GUARD NEWS

Year of Opportunity

The importance of the **Air Reserve Forces Policy Committee** as an advisory body to the Secretary of the Air Force was emphasized by **Under Secretary Joseph V. Charyk** in welcoming committee members to their fall meeting in Washington last month.

Noting that **significant changes** are taking place in all elements of the Air Force, Mr. Charyk said:

"I think it's doubly important, then, that we have the benefit of your thinking and your advice on making sure that we adapt ourselves to the changing conditions. . . .

"In particular, we look to this committee to come up with policy recommendations and suggestions that will help us to do a better job."

William P. Wright, Jr., Deputy for Reserve Forces in the Secretary's office, said the air reserve forces face "a **year of great opportunity.**" Mr. Wright, a reserve colonel from New York, sat on the committee before he was appointed to his present post last summer.

"I feel this is a **particularly critical year** for the air reserve forces," he said, "with new plans, new procedures, and new lines of responsibility affecting both the unit and individual programs of the Air Force Reserve and the Air National Guard.

"I also believe it is a **year of great opportunity** for the air reserve forces. Many matters of policy are sure to arise that will be referred to this committee. . . .

"I am confident the Air Force will remember this year and next year as a period when the reserve forces reached their greatest capability and readiness, and closest integration with the regular forces."

The committee led off its fall session with a visit to **SAC Headquarters** at Offutt AFB, Neb., and to the **Air Defense Command facility** located at Richards-Gebaur AFB, Mo. At the latter station, they heard a progress report on **reserve recovery and base support units** being organized there.

In its business sessions, the committee concurred in establishment of **reserve forces policy committees at gaining command headquarters** and recommended a **monetary clothing allowance for reserve forces airmen.** These measures are further covered below.

Among **other recommendations** approved by the committee:

- That **reserve forces unit commanders** may appeal to USAF the designation of members of their units as **"key personnel"** of federal civilian agencies. Under existing procedure, a reservist so designated by his government employer **must be released from the unit.**
- That **ANG officers occupying colonel or general officer positions** above the grade they hold, and who are **twice passed over** for promotion, should be **reassigned** to a position in their actual grade.
- That the **grade at which individuals may enlist** in the air reserve forces after serving in another branch of the armed forces should be **determined on the same basis as for Air Force veterans.**
- That the Secretary of the Air Force should **continue the present policy of prescribing identical uniforms** for the reserve forces and the active Air Force.
- That the Air Force initiate legislation to **equalize the payment of per diem to inactive-duty reservists** with that of active-duty personnel.

Among **proposals rejected** by the committee:

- That **basic training** for nonprior service Air Guardsmen be **extended to six months.**
- That air reserve forces line officers who subsequently qualify for appointments as **doctors or chaplains** should be permitted to **transfer** to the latter career areas in grade.
- That the **$50 uniform** maintenance allowance authorized reservists each four years should be **paid to those officers otherwise ineligible** for the allowance who perform short tours each year. (The allowance is payable only to reservists who earn at least thirty-five points a year in training sessions requiring wearing of the uniform.)

New Policy Committees Okayed

Reserve forces **policy committees** are to be set up at **four gaining command** headquarters under provisions of a rewritten **AFR 45-9** which has gone to the printers after being approved by the Air Reserve Forces Policy Committee.

The major command committees—to be established at **TAC, ADC, MATS, and CONAC**—will succeed to the functions of those which formerly operated under the numbered Air Forces.

Composition of the committees at TAC, ADC, and MATS will correspond to the parent committee at USAF level, with **six members each from the Air Guard, the Air Reserve, and the active Air Force.** At command level, however, the committees will include at least one ANG and AFRes airman. CONAC's committee **excludes Air Guardsmen,** since no ANG units come under CONAC.

The new AFR 45-9 will also authorize **individual reservists with mobilization assignments** in other Air Force commands to **submit policy recommendations** through their command channels. The recommendation may be acted upon by the major commander if it comes within his authority. If not, it **goes forward** with the commander's comments to the **Assistant Chief of Staff for Reserve Forces** in the Pentagon to be referred to the next meeting of the parent policy committee.

The regulation also confirms that there is to be **only one executive secretary for the over-all policy committee** at USAF. Until about a year ago, both the Air Guard and the Air Force Reserve panels were authorized a full-time executive secretary.

New Roles for ANG

As forecast in the October "Ready Room," the **Air National Guard** has announced plans to **convert seventeen squadrons to new missions** over the next two years.

Maj. Gen. Winston P. Wilson, the National Guard Bureau's deputy chief, said **nine** will go into **long-range heavy transport, four** into **tankers,** and **four** into **aeromedical evacuation roles.**

Fifteen of the squadrons affected will switch over **from air defense missions** and **two from tactical reconnaissance,** he said.

When these changes are completed, the Air Guard's ninety-two squadrons will be made up of: twenty-six **air defense,** twenty-one **tactical fighter,** fifteen **long-range transport,** twelve **tactical reconnaissance,** nine **aeromedical evacuation,** four **tanker,** four **medium troop transport,** and one **medium transport.**

Like the Guard's six existing heavy transport squadrons,

(Continued on following page)

the new units will be equipped with **Boeing C-97s,** some of which may be modified from tanker configuration. The new **medical evac units** will start with **C-119s** transferred from **Air Reserve units** as the latter get new equipment, but some are expected to acquire **four-engine aircraft in about a year.**

Squadrons scheduled for conversion to heavy transport include the 105th and 155th tac recon squadrons of **Nashville and Memphis, Tenn.,** plus these now in air defense missions: 128th, **Marietta, Ga.;** 142d, **Wilmington, Del.;** 158th, **Savannah, Ga.;** 185th, **Oklahoma City, Okla.;** and the 191st, **Salt Lake City, Utah.** The other two will be named later.

Tankers will go to the 108th, **Chicago, Ill.;** the 103d, **Philadelphia, Pa.;** and the 126th, **Milwaukee, Wis.** The fourth will probably be based in Ohio (*see below*).

First-place trophy for 1960 CONAC troop carrier meet goes to Maj. R. C. Shoemaker, right, captain of the team representing TAC's 463d Troop Carrier Wing, Sewart AFB, Tenn. Maj. Gen. A. F. Kalberer, Vice Commander of CONAC, makes presentation. This year, for first time, three TAC teams competed with AFRes troop carrier wings.

Scheduled to go into aeromedical evac roles are the 156th, **Charlotte, N. C.,** and the 187th, **Cheyenne, Wyo.,** with two more to be designated later.

General Wilson reported that squadrons remaining under ADC and TAC "will be given high priority in training and equipment."

Paragons of Paradrop

Versatility and skill of **Tactical Air Command's** active and reserve troop carrier units were demonstrated in CONAC's 1960 Troop Carrier competition at **Fort Campbell, Ky.,** October 20-22.

This was the fourth annual competition, and the first since TAC assumed operational control of CONAC's fifteen troop carrier wings.

TAC's 463d Wing, **Sewart AFB, Tenn.,** won with Lockheed C-130s. Second place went to the reserve 403d Wing from **Selfridge AFB, Mich.,** flying Fairchild C-119s, and third to TAC's 464th Wing, **Pope AFB, N. C.,** employing Fairchild C-123s.

Fifteen Air Force Reserve and three TAC wings each entered three top crews, made up of pilot, copilot, navigator, flight engineer, and loadmaster. They flew three missions—**a night celestial navigation run, an early morning paratroop drop, and a daytime heavy-cargo drop.**

Paratroopers of the **101st Airborne Division** at Campbell joined in the meet, marking the first time such troops have been used.

The first mission was flown entirely **by celestial navigation** over a triangular course, winding up with a small cargo drop on an unmarked drop zone.

In the second event, the paratroop drop, umpires rated crews on **formation flying, crew coordination and discipline, and flight safety procedures** as well as on accuracy of the drop.

On the final mission, each crew was judged on **accuracy in dropping two tons of cargo.**

While judges were totaling the scores, the reserve's 445th Wing of **Dobbins AFB, Ga.,** and TAC's 464th Wing from **Pope AFB** demonstrated C-123 assault landing techniques.

Fourth place went to TAC's 314th Wing, **Sewart AFB, Tenn.,** followed by the 349th, **Hamilton AFB, Calif.;** 440th, **Mitchell Field, Milwaukee, Wis.;** 445th, **Dobbins AFB, Ga.;** 442d, **Richards-Gebaur AFB, Mo.;** 459th, **Andrews AFB, Md.,** and 445th, **Homestead AFB, Fla.**

Airman Clothing Allowances

Monetary clothing allowances, which would put air reserve forces airmen on a basis **equivalent to that of active Air Force airmen** in maintaining their own uniforms, has been recommended by the Air Reserve Forces Policy Committee and is expected to be approved by the Secretary of the Air Force.

Under the system, each reserve forces airman will be **started out with a complete set of serviceable uniform items.** Thereafter he will receive a **monetary allowance** sufficient to keep his uniforms **in good condition** and to provide for **replacement of worn items.**

Airmen in their first three-year enlistment will draw **$12 a year** after the first year. Those with more than three years' service will get **$18 a year.**

Extra uniform items are provided for airmen ordered to **tech schools and to NCO academies.**

When the plan goes into effect, reserve forces airmen will be **authorized to wear the uniform to and from training sessions.**

Transatlantic Pickup

Some **250 Air Force Reserve** aircrew members will go to France in January to pick up surplus **Air Force C-119s** at Dreux Air Base, to be ferried back to Air Force Reserve units.

Aircraft were made available as a result of **deactivating two USAFE troop carrier squadrons** at Dreux.

Crews will fly over in reserve C-119s.

Reservists were given the assignment in line with USAF policy to provide **productive peacetime missions** for reserve forces and to **fulfill reserve training** requirements for overwater missions.

Moving Day

Relocations are in the works for at least **three ANG squadrons.** The 140th Aeromedical Evac Squadron now at **Spaatz Field, Reading, Pa.,** is moving about forty miles to **Olmstead AFB at Middletown, Pa.**

Negotiations are in progress to move another Pennsylvania squadron, the 103d, now based at **Philadelphia International Airport,** to the **Naval Air Station at Willow Grove, Pa.**

And the Air Guard is interested in acquiring facilities at **Clinton County AFB, Ohio,** which the Air Force has earmarked for deactivation. ANG may put its fourth tanker squadron there.—END

The Later Years

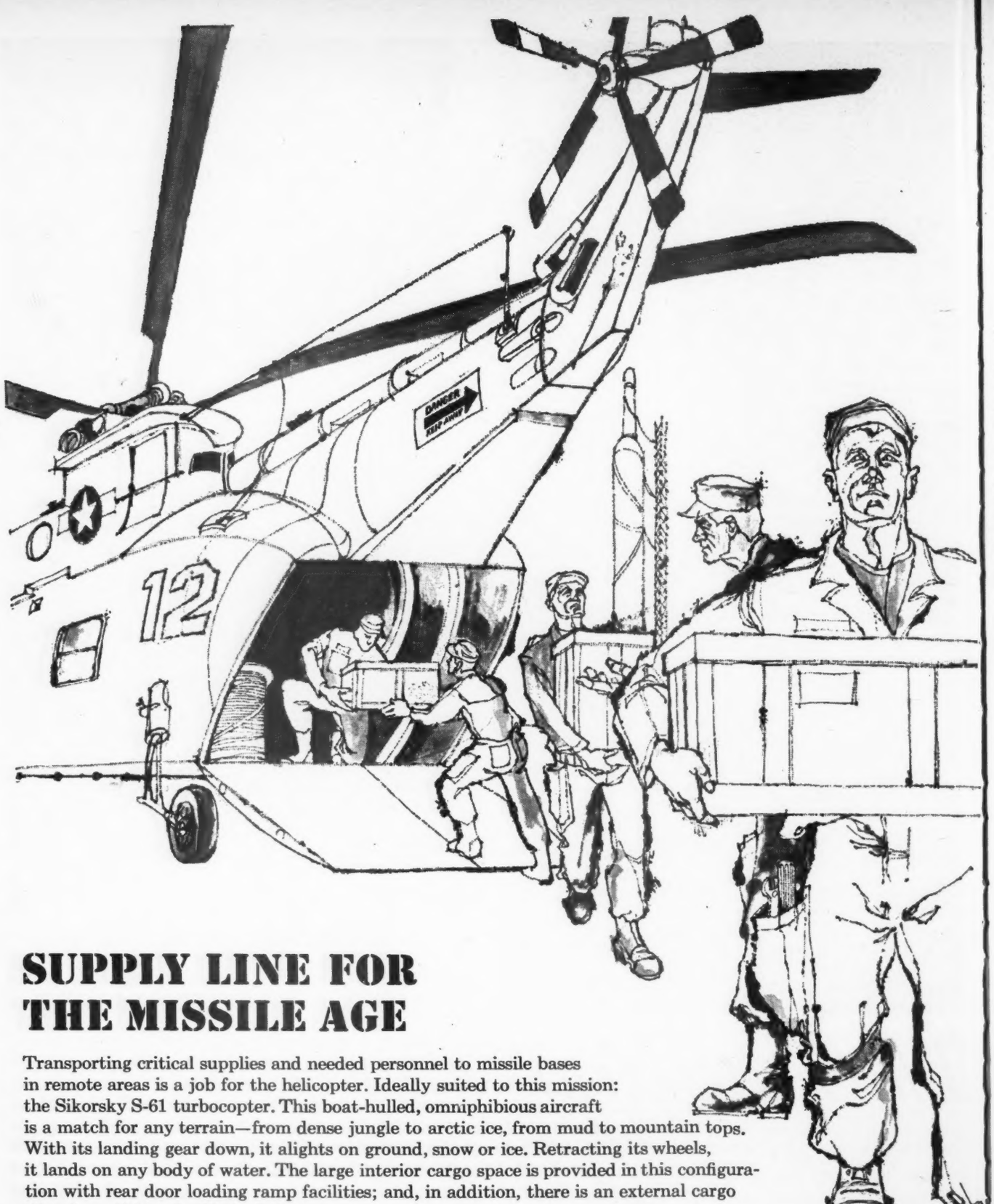
People look to you for guidance, respect your executive position, honor you for your achievements.

In these later years all that you are, all that you have learned and experienced, all that you have accomplished is evident.

If you are among those young Air Force officers who are thinking about an Air Force career, these years should be considered a goal. For if you are accepted for a full Air Force career, it is then that our nation will *most* depend on your leadership, your judgment...and you.

The later years are an important part of what makes the whole thing worth working for.

There's a place for tomorrow's leaders on the Aerospace Team



SUPPLY LINE FOR THE MISSILE AGE

Transporting critical supplies and needed personnel to missile bases in remote areas is a job for the helicopter. Ideally suited to this mission: the Sikorsky S-61 turbocopter. This boat-hulled, omniphibious aircraft is a match for any terrain—from dense jungle to arctic ice, from mud to mountain tops. With its landing gear down, it alights on ground, snow or ice. Retracting its wheels, it lands on any body of water. The large interior cargo space is provided in this configuration with rear door loading ramp facilities; and, in addition, there is an external cargo sling for articles of unlimited size.

This new S-61 troop and cargo transport is powered by twin gas turbines, delivering 1,250 shp each. It offers all-weather operation—plus greater range and cruising speed than any previous Sikorsky transport copter. Commercial S-61's are now in production for delivery to helicopter airlines in 1961.

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AFA NEWS

SQUADRON OF THE MONTH

Ogden, Utah, Squadron, Cited for

continued outstanding success in presenting the airpower story to the community, and for indoctrinating other community organizations into the pattern of its programs.

Photographs on this page depict a small part of the mammoth **Weber Valley Air Fair** in Utah. It was co-sponsored again this year, as it has been for four years, by the **Ogden AFA Squadron** and **Chamber of Commerce,** the **Roy, Utah, Jaycees, Weber County Jeep Posse, Ogden and Weber CAP,** and **Ogden Chapter of the Experimental Aircraft Association. Robert P. Stewart,** Ogden AFA Commander, served as General Chairman of the program, which attracted more than 75,000 people. Several other AFAers served as Committee Chairmen.

The Navy's **Blue Angels** aerobatic team highlighted the activities, which also included parachute jumps, lightplane acrobatics, and a static display of historical and modern aircraft. **Linda Bement,** 1960's Miss Universe and a native of Salt Lake City, was also among the Fair's attractions.

Stewart reports the 1960 Air Fair was a great success. We're proud of the Air Fair, and happy to name Ogden as **Squadron of the Month** in recognition of this outstanding effort.

* * *

The appointment of the first 1960-61 **national committee** has been announced by AFA President **Thos. F. Stack.** The **Organizational Advisory Council,** which replaced the National Wing Advisory Council following the 1959 National Convention, will be composed of **seven former Squadron Commanders** under the chairmanship of **O. Donald Olson,** Colorado Springs, Colo., this year's AFA Man of the Year.

Members of the Council, which is established to serve as liaison between the Wings and Squadrons and the President, are **Charles L. Collins,** Massachusetts; **G. Reid Doster,** Alabama; **Robert W. Gerlach,** Wisconsin; **Joseph L. Hodges,** Virginia; **Joseph C. Jacobs,** Utah; and **Ronald B. McDonald,** California. All have accepted the appointments. First meeting will probably be held in early December.

In naming these AFA leaders, Stack emphasized his confidence that the new Council "would continue the great job that each of these men has done in his own Squadron."

* * *

Chico, Calif., Squadron, winner of the Association's plaque for outstanding programs in San Francisco, observed its third anniversary with a banquet on October 28. The unit couldn't have selected a more appropriate speaker. **Jimmy Doolittle,** founder of AFA and Board Chairman of the Space Technology Laboratories, delivered the principal address, warning that "**Unless we speed up,** or the Russians slow down, they will exceed us in all areas to which they assign high priority."

Tom Mason, Chico Squadron Commander, was in charge of the program. **Jean Morony** served as Toastmaster. Honored guests included **Maj. Gen. Osmond Ritland,** Commander, Ballistic Missiles Division, ARDC.

* * *

Little Rock Squadron, one of our newest, has its first big program under its collective belt. It was a good one. In cooperation with the Cham-

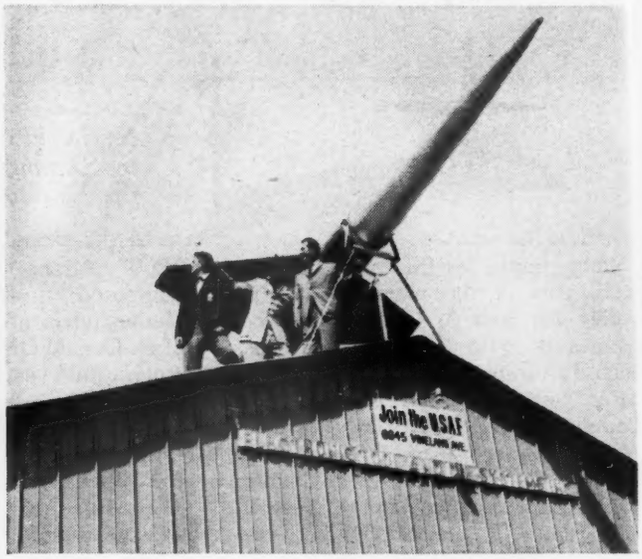
(Continued on following page)

At National Guard conference in mid-October at Honolulu, California ANG Maj. Gen. Clarence Shoop, AF Under Secretary Joseph V. Charyk, Illinois Guard Brig. Gen. Howard T. Markey.

Fokker Triplane on display at Weber Valley Air Fair in Utah, where it was one of old airplanes exhibited along with more up-to-date hardware in giant one-day event run each year by Ogden Squadron and other area organizations.

Navy's Blue Angels aerial team performed at Fair. Here Ogden AFA Commander Robert P. Stewart, left, with Miss Universe 1960, Utah's Linda Bement, Blue Angels Lt. Cmdr. Jack Reavis, far right, and Lt. Duke Vermiglia, center.

Howard Eichner, right, Commander of New York's Mitchel Squadron, presents Association membership to A1/C Ray Tysol, Mitchel AFB airman of the month. Each command airman honored receives free membership from Squadron.



San Fernando, Calif., AFA Squadron's Bill Barcoff atop plant building where he established Air Force recruiting substation. Barcoff is one with hand on obsolete drone stand. With him are USAF Maj. John McCarty, Dan Velasco.

bers of Commerce of **Little Rock, North Little Rock, and Jacksonville,** the outfit sponsored a missile briefing for over 250 top civic, business, and governmental leaders on October 6. A luncheon preceded the briefing, which was presented by **Col. John L. Zoeckler,** Chief of Staff, AMC Ballistic Missiles Center, Inglewood, Calif.

The Little Rock area will be the hub of an **eighteen-silo Titan II missile complex** now undergoing construction. A number of mayors and chamber officials of the areas near the planned silos attended the program, which was designed to familiarize community leaders with USAF missile and space programs. AFA's **Willard A. Hawkins** was in charge of the event.

• • •

There were **fifteen resolutions** approved by the delegates to the fourteenth annual National Convention in San Francisco. Three concern **internal organizational policy.** One limits to three **the consecutive terms that a Regional Vice President may serve.** The second **approves a system of submitting publicity regarding AFA units through the respective Wings** and then on to Headquarters. The third approves a **single identification pin for all AFA members** regardless of membership category. The categories themselves—**Regular, Service, Associate, and Cadets**—were not changed. The other twelve resolutions were reported in last month's "Ready Room" column and Convention report.

• • •

Michigan Wing Commander **Bob Saltsman** advises us that the **Norman Lyle Squadron in Birmingham** has successfully delivered an obsolete F-86 jet to the grounds of Eton Park in that city. The effort, which has been under way for several months, was spearheaded by **Saltsman, Jim McPartlin,** Squadron Commander, and **Col. Charles Sonnkalb,** Selfridge AFB.

Charles Gale, Superintendent of Parks & Forestry for Birmingham, and a crew of officials from his office, handled the laborious task of towing the plane from Selfridge AFB, Mich., to the park. Saltsman reports the operation required lots of work but was well worth the effort.

• • •

"Man's Future in Aerospace" was the title of a well received lecture at the **University of Nevada** by USAF **Lt. Col. Edwin J. White, Jr.,** on October 18. The lecture was arranged by **Dr. Calvin Reed,** Associate Professor of Education, a member of **AFA's Aerospace Education Council.** He got his inspiration for the program during the Council's visit to Air University last spring, and advises us the Nevada function made a tremendous contribution to the faculty and students.

Colonel White, assigned to Stead AFB, Nev., is a graduate of Air War College. He was selected for this special duty at the University by the Secretary of the Air Force.

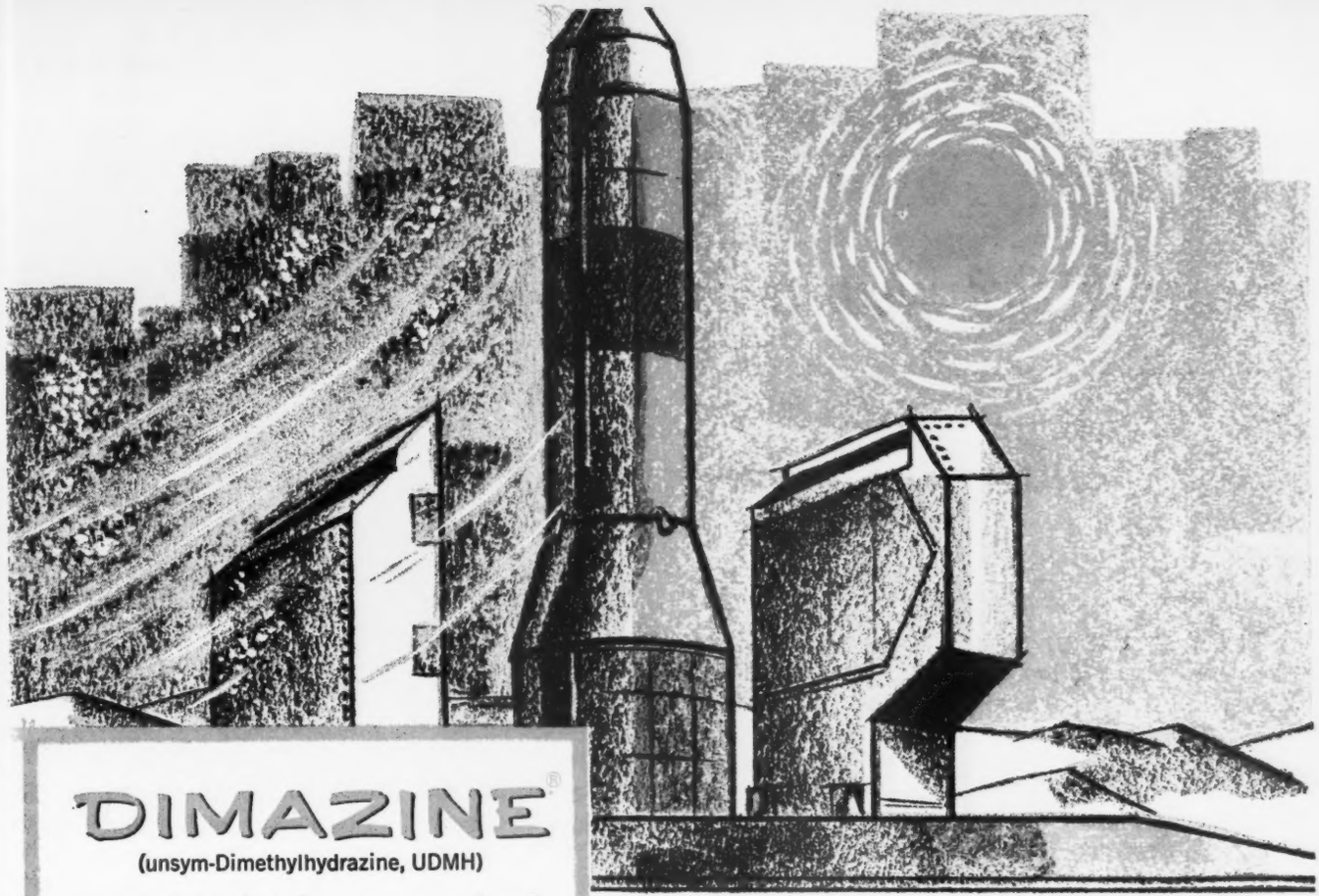
• • •

Bill Barcoff, a past officer and current member of **California's San Fernando Squadron,** has developed his own method of contributing to the USAF search for qualified young men. He has established a substation of the local AF Recruiting Group in his plant and, to call attention to this new wrinkle, has mounted an **obsolete drone atop** the building (*see cut*). To help with the inquiries, he also added a **retired USAF recruiter** to the payroll. Barcoff reports that a steady stream of persons seeks information.

• • •

CROSS COUNTRY. . . . **Pittsburgh Squadron's Kay and Bob Patterson** are starting their fourth year of instruction with the **Falcons,** a group of twenty-seven boys at **Samuel Hamilton Junior High School** who are learning the rudiments of flying and model building. . . . The excellent programing of this same Squadron is gaining recognition, too. **Ruth Young and Carl Long,** both members of Pittsburgh, have been invited to attend a meeting of the **New Jersey Wing** and advise the Wing staff on programs. . . . **Ralph Whitener,** who left AFA's Headquarters Staff last spring, began a new assignment as **Director General of National Aeronautics Association,** November 1, with offices in Washington. . . . **Walt Bonney,** long-time National Director and national committee member, leaves NASA on November 16 to take over as **Director of Public Relations for Aerospace Corp.,** with offices in El Segundo, Calif. He held a similar job with NASA, and before that with NACA, for twelve years. . . . Plans for a national observance of **AFA's anniversary** will be announced shortly. All AFA units will receive suggestions on programs for local celebration.

—Gus Duda



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40-44	13,500	17,500
45-49	12,500	13,500
50-54	10,000	10,000
55-59	10,000	10,000
60-64*	7,500*	7,500*

*Continuing benefits. Policy must be purchased prior to Age 60.

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☐ I am currently on flying status.
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airman's bookshelf

Another Defense Critique

***Countdown for Decision*, by Maj. Gen. John B. Medaris, US Army (Ret.), with Arthur Gordon (G. P. Putnam's Sons, New York, 1960, 302 pp., $5)**

Reviewed by Dr. Alfred Rockefeller, Jr.

General Medaris, the retired Army missile and space chief, here sharply criticizes large segments of the national defense effort. *Countdown for Decision* concentrates on General Medaris' experiences from 1955 to 1960, during "those hurried years when the space age was born" and when he served as head of Army ballistic missile and space programs. The story includes prideful successes, frustrations, and defeats. General Medaris' central thesis is that our process of arriving at national military decisions has become frighteningly confused, weakened, delayed, and compromised by the multiplicity of forces at work.

General Medaris, who has harsh words for many aspects of our military establishment from the Joint Chiefs upward and downward, reserves his sharpest barbs for the Air Force. In his view, it was fundamentally unwise in 1947 to set up USAF on the basis of an instrument rather than on a mission to be accomplished, at a time when he considers the day of the manned aircraft was past high noon and pilots were soon to be victims of technological unemployment. He concludes that the result has been an over-all Air Force inferiority complex and an "overcompensation" that has led to the creation of an enormous propaganda machine.

Medaris feels that USAF, because of the circumstances of its creation, lacks sound, experienced military-technical organization, and has become almost a slave of the aircraft and associated industries, subject to endless pressure and propaganda. Foremost complaint here would appear to be that USAF did not utilize the Army arsenal development system.

The general is as positive in his recommendations as in his fault finding. Administratively, he urges streamlined channels of decision and responsibility; a single Chief of Staff of the Armed Services; recombination of the Army and the Air Force; a nine-tenths reduction of the DoD civilian staff, and a fifty percent reduction in the number of DoD and armed services assistant secretaries.

To further forestall the accountants and bookkeepers who are replacing leaders, strategists, and tacticians, he declares, the budgetary process should be revised to let the Bureau of the Budget advise the President on the budget before it is presented to Congress. After that, funds voted by Congress should be directly available to the Secretary of Defense and the services, he says.

Nationally and militarily, General Medaris advocates a fundamental and searching reexamination of our military policy, which he says should be implemented by timely, intelligent, forceful decisions; more emphasis on advanced research and less preoccupation with specific hardware development; self-contained, globally mobile lightweight forces to deal with local threats, backed up by centralized reserves. And, for the civilian population, he advocates a positive civil defense program that will teach the people how to react in an emergency.

On the policy of massive retaliation, Medaris is equally critical of our "overkill" riches in nuclear weapons, of too many different ICBMs. To him the most important weapon development of today is the Nike-Zeus antimissile missile as a shield to blunt any ballistic missile attack. With mobility and concealment as the key to his choice of weapons, he recommends Polaris and air-launched ballistic missiles like USAF's Sky Bolt as the best strategic weapons for the future.

On the national space effort, the Medaris position will find agreement among many. He is critical of the national space policy of separation into military and civilian compartments, of division of the indivisible, with resultant inefficiency and duplication of effort.

There is little new or novel in Medaris' criticisms or recommendations. They are in the main a compilation of many that have been expressed vocally and in print for the past few years. His book is interesting and provocative; it represents the conclusions of a dynamic, positive, intelligent officer, which will be of value to the general public interested in gaining some insight into the problems—and frustrations—of a military officer charged with high responsibilities in a new area. However, it should be read with caution, for the closer one gets to controversial matters in which Medaris and his command had a vital interest, the more apt the account is to exhibit the position of a partisan participant.

About the reviewer: *Alfred Rockefeller, Jr., is presently Historian, Air Force Ballistic Missile Division, Air Research and Development Command.*

The B-70: A National Breakthrough

***The Manned Missile: The Story of the B-70*, by Ed Rees (Duell, Sloan & Pearce, 1960, 182 pp., $3.50)**

Reviewed by Maj. Abbott C. Greenleaf

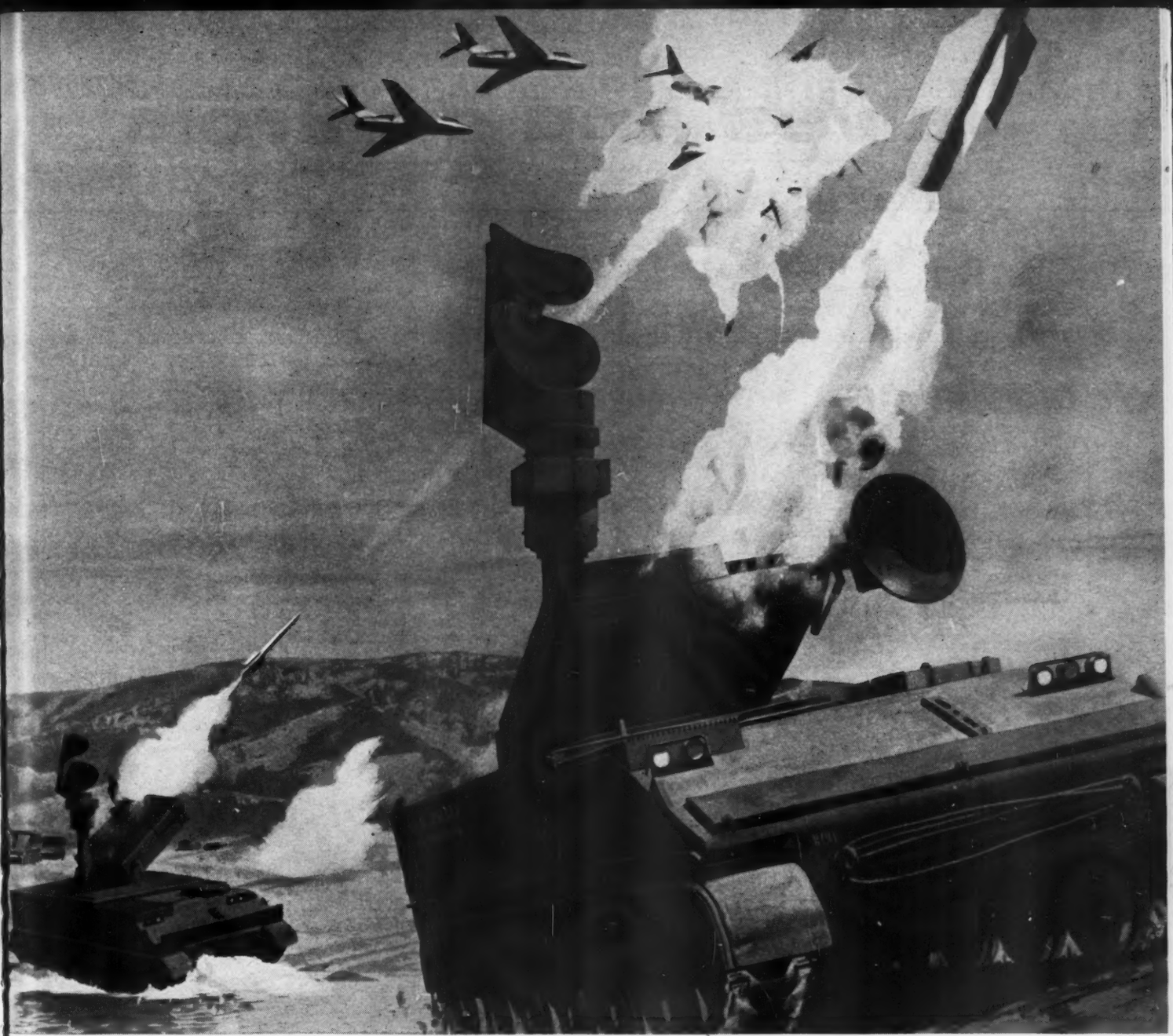
Ed Rees, *Time's* Senior Military Correspondent, skillfully tells the story of the B-70 in its manifold facets in his new book, *The Manned Missile: The Story of the B-70.*

Complex issues of strategy, economics, technology, politics surround the B-70. Mr. Rees's task was not an easy one. His results indicate careful and thorough research. The author meets each of these major factors head-on—and manages to write an exciting, highly readable book in the doing. He presents, among other things, a solid account of decision-making at the highest levels, plus rare insight into the legal complexities of negotiating a multibillion-dollar development contract.

The Manned Missile is also a commentary on the "cost squeeze" in which so many modern weapon systems have been caught. Over the last few years there has not been sufficient funding available to finance all of the major programs advanced by the military services. Some would argue that greatly increased defense budgets would eliminate the cost squeeze. Yet, other observers of national military policy contend that even if more funds were made available, the cost squeeze would continue. To this latter group, the rate of cost increase in such military areas as research and development, personnel, base support, strategic survivability, and the like, far exceeds the most optimistic suggestions which have been made for higher defense spending.

In this environment, priorities must be assigned among many essential national military tasks and defense funding must support such priorities. The B-70 obviously deserves a top-priority rating. It is a future weapon

(*Continued on page 143*)



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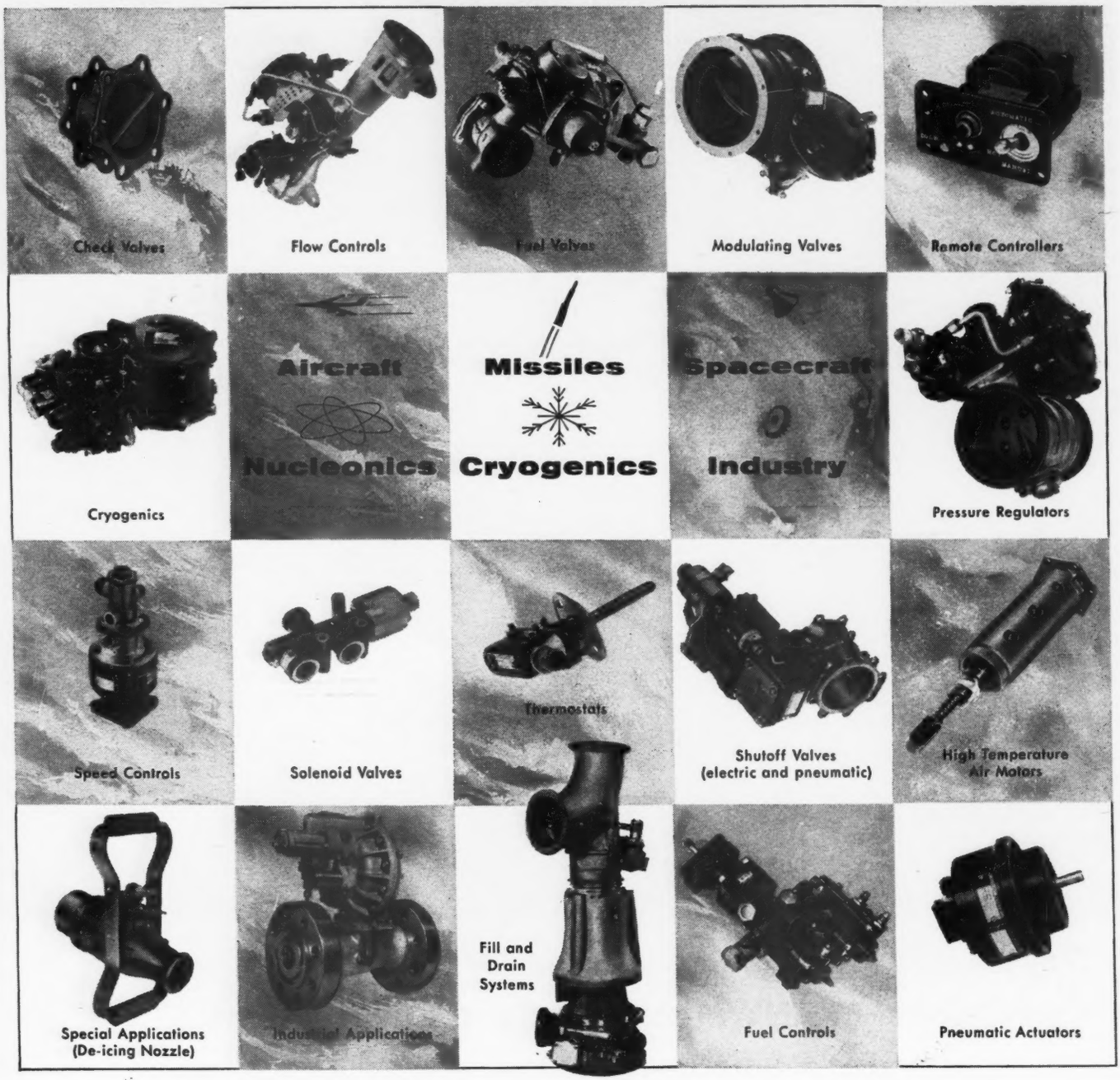

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"The B-70 will be the first of a new series of airplanes. It will put flight on a new plateau of speed, and its growth versions will go to Mach 4 and Mach 5 and higher. If the war it is being built to fight does happen, it will be the United States' most powerful weapon and perhaps its only hope for victory, however meaningless this may be. If the war doesn't happen because it has deterred it, the B-70 will have many adaptations—as a supersonic transport, as a patrol vehicle for a world police force, as a satellite launcher, as a flying laboratory to help men study the phenomenon of high speed and high heat in nature's wind tunnel."

For the few hours it takes to read, *The Manned Missile* will delight the aviation enthusiast and will greatly interest the serious student of national security policy. Part documentary, part analysis of top-level decision-making, and part argument for full exploitation of the B-70's potentialities, it is a book which should be read by those who are concerned with our future national defense posture.

About the reviewer: *Major Greenleaf is a member of the Long-Range Objectives Group, Directorate of Plans, Hq. USAF.*

Roll of Honor

Dick Bong, Ace of Aces, by Gen. George C. Kenney, USAF (Ret.) (Duell, Sloan & Pearce, $2.95), honors the top US air ace of all time—Maj. Richard Ira Bong. In the foreword to this memorable biography of a great flyer, General of the Army Douglas MacArthur singles out Bong as one man who has "provided an imperishable inspiration to victory in all who have since or may in the future rise in mortal combat to meet the challenge to American air dominance."

General Kenney writes the Bong story from boyhood—early harebrained-but-skillful flight antics, the glorious combat career in the South Pacific, test pilot duty back in the States that led to his death. One day in 1945 General Kenney received two fateful messages. One told him Hiroshima had just been destroyed in history's first atomic bombing. The other announced that Dick Bong was dead. The new P-80 fighter Dick was testing at Lockheed had flamed out on take-off. The entire Air Force felt the loss.

General Kenney writes of air combat with precision, feeling, and authority. He interweaves with the Bong story tales of other great aviators who served under him. Among these were Tommy McGuire and Neel Kearby, who along with Bong won Congressional Medals of Honor for their exploits.

The biography of another of the great figures in US air history is presented in *First of the Spacemen: Iven C. Kincheloe, Jr.,* by James J. Hag-

(Continued on following page)

Solong, JET AGE JOE

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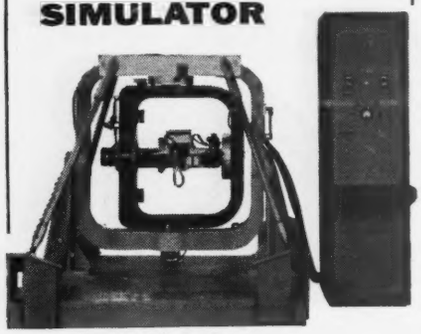

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Captain Kincheloe, who set the world's altitude record at 126,200 feet in the X-2 rocket plane in 1956, died in an F-104 accident at Edwards AFB in 1958.

In many respects Kincheloe and Bong were products of the same mold. Kincheloe emerged from Korea a double ace, a precision man in the cockpit with the incurable desire to fly. Yet the two differed just as the technology of World War II aeronautics differed from the technology of the jet and space age. Kincheloe, typical of many of the best postwar flyers, had an engineering background in addition to pilot skill.

Haggerty masterfully writes of the X-1 and X-2 and of Kincheloe's duties at the Empire Test School in England and at Edwards in a variety of postwar craft. He creates an excellent combat narrative of jet war in Korea.

It was in the X-2 that Kincheloe earned the title "first into space." His 126,000-foot altitude record held for four years. Maj. Robert M. White broke this mark in a 136,500-foot flight in the X-15 on August 12, 1960.

This is a book veteran aviation writer Jim Haggerty had to write. He and Kincheloe were close friends. Here is both an adventure story and a memorial to a flyer who helped write recent aerospace history.

Aerospace Books

High hope of NASA's Project Mercury is to put one of the seven United States Astronauts in orbit in 1961. Two new books have appeared on the subject.

Martin Caidin's *The Astronauts: The Story of Project Mercury, America's Man-in-Space Program* (Dutton, $3.95) packs a mass of facts in a pleasing easy-to-read narrative. It traces the program, the selection of the seven men now in training, their qualifications and rigorous duty in preparation for the first orbital flight. In speculative manner, Caidin creates the tense drama of the launch, the orbit, and the descent after the third circuit around the earth. Photos and Fred Wolff drawings are laced through the narrative.

In similar vein former Navy pilot Joseph N. Bell's *Seven into Space* (Hawthorne Books, $3.95) traces the project's history, the men, their background, personalities, and their training for the great adventure ahead. Well illustrated, it provides a clear, concise picture of the program. While neither volume offers anything new to this already-well-publicized venture, both are informative and interesting documentaries.

The story of the DC-8, latest in a long, distinguished line of dependable Douglas aircraft, comes under the facile pen of Richard G. Hubler in *Big Eight: A Biography of An Airplane* (Duell, Sloan & Pearce, $5). More than one-third of the book sets the DC-8 against the proud history of Douglas, from its small beginnings on Wilshire Boulevard making the famed "World Cruisers" for the historic 1924 flight. This portion will appeal to AF people everywhere like a family album — the DC-3, -4, -6, -7, the C-124 and -133. It is filled with nostalgic memories.

Arthur C. Clarke's new revised edition of *Interplanetary Flight* (Harper, $3.50) adds a new chapter "Earth Satellites and Lunar Probes" and new material on Atlas, Kiwi-A, Sputniks, Explorers, Luniks, Project Mercury, captive orbits, fuels, accelerations, ion rockets, Van Allen radiation belts, and other topics to bring it completely up to date.

—Maj. James F. Sunderman

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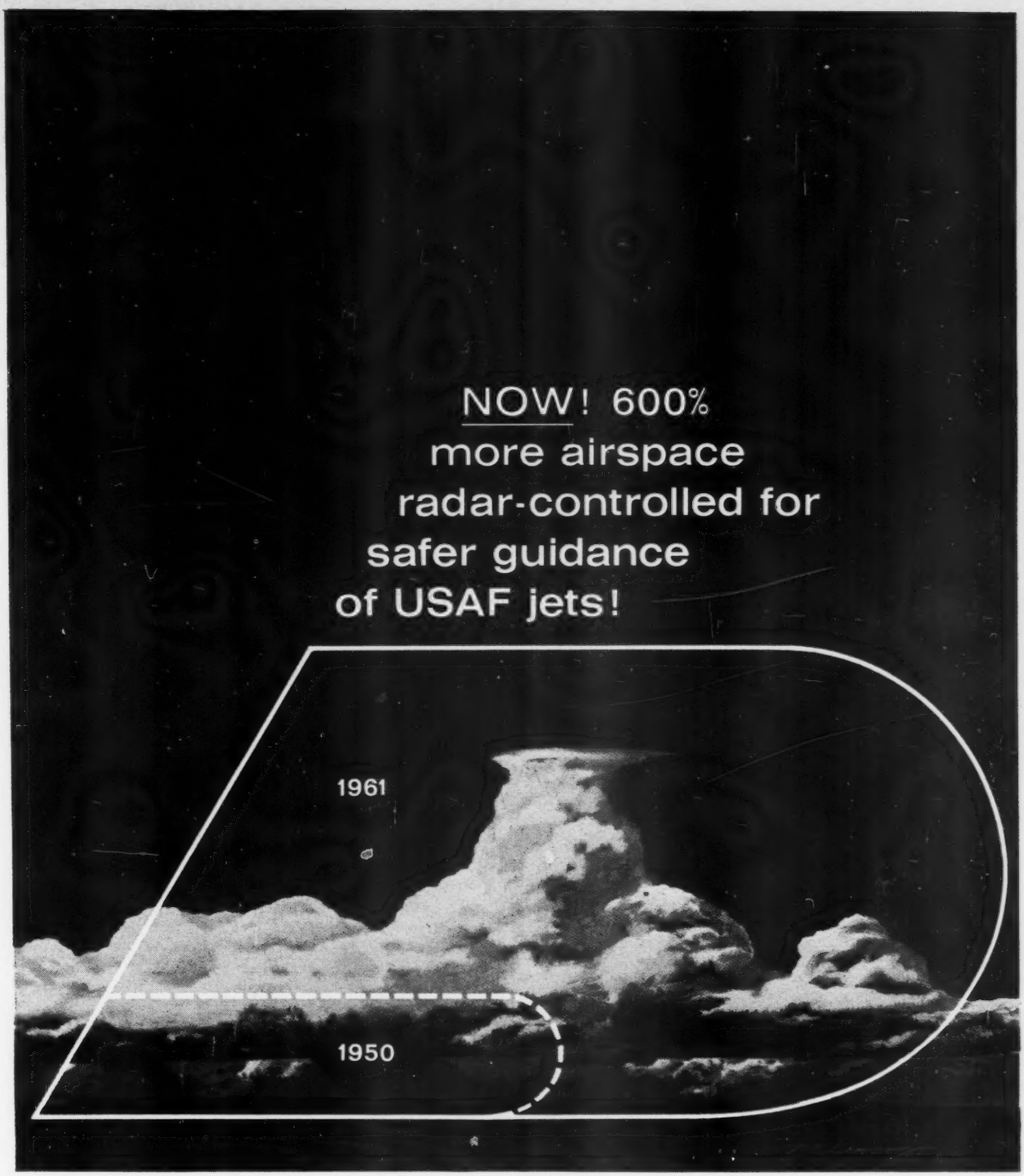

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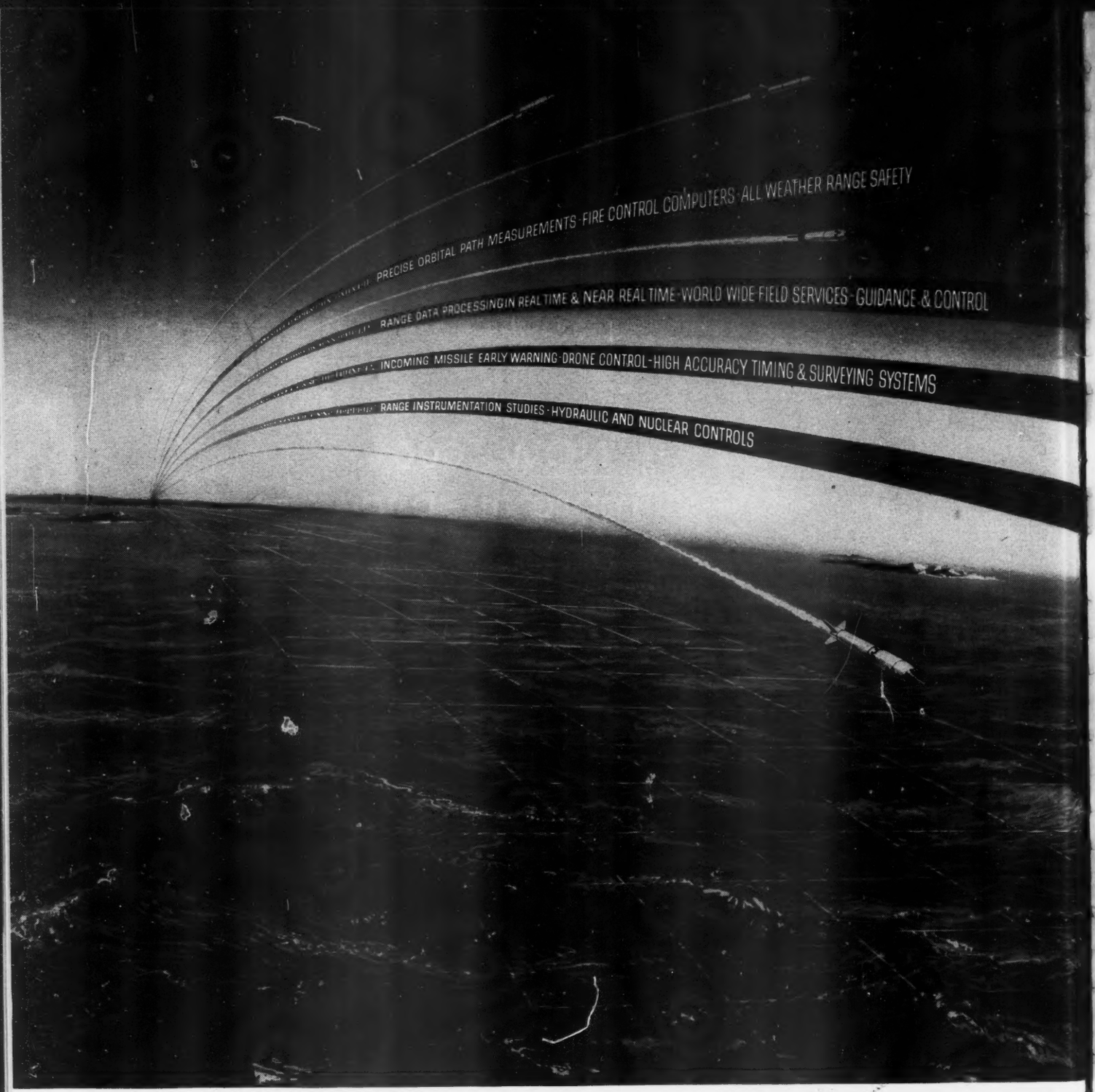
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INDEX TO ADVERTISERS

Aerospace Corp. 96
Aircraft Radio Corp. 119
AiResearch Manufacturing Co., Div. Garrett Corp. 142
Allison Div., General Motors Corp. ..... 34 and 35
American Machine & Foundry Co., Government Products Group 13

Beech Aircraft Corp. 61
Bell Aerospace Corp. ..... Cover 3
Bendix Radio Div., Bendix Aviation Corp. 36
Boeing Airplane Co. ..... 16 and 17
Bristol Siddeley Engines Ltd. 125
Burroughs Corp. 7

California Technical Industries, Div. Textron, Inc. ..... 32 and 144
Cessna Aircraft Co. 12
Chlor-Alkali Div., Food Machinery & Chemical Corp. 137
Clifton Precision Products Co., Inc. 100
Continental-Emsco Co., a Div. of the Youngstown Sheet & Steel Co., Dallas, Tex. 33
Continental Motors Corp. 147
Convair, a Div. of General Dynamic Corp. ..... Cover 4

Delco Radio, Div. of General Motors Corp. 31
Douglas Aircraft Co., Inc. 81

Electronic Communications, Inc. .. 1
Elgin Micronics, Div. of Elgin National Watch Co. 22

Food Machinery & Chemical Corp. ..... 20 and 21
Francis Aviation 143

General Electric Co., HMED ..... 56 and 57
Gilfillan Brothers 145
Government Products Group, American Machine & Foundry Co. 13

Hallicrafters Co., The ..... 128 and 129
Hamilton Standard Div., United Aircraft Corp. ..... 108 and 109
Hiller Aircraft Co. 25
Hughes Aircraft Co. ..... 82 and 83

I. T. E. Circuit Breaker Co. 130

Kaman Aircraft Corp. ..... Cover 2
Kollmorgen Optical Corp. 91

Laboratory for Electronics 14
Lockheed Aircraft Corp., Georgia Div. ..... 2, 3, and 53
Lockheed Aircraft Corp., Missiles & Space Div. 99
Lockheed Electronics Co., Military Systems/Stavid Div. ..... 122 and 123
Loral Electronics Corp. ..... 86 and 87

Magnavox Co., The, Government & Industrial Div. 28
McDonnell Aircraft Corp. 66
Monsanto Chemical Co., Organic Chemicals Div. ..... 8, 9, and 10

Pratt & Whitney Aircraft Div., United Aircraft Corp. 62

Raytheon Co., Equipment Div. 141
RCA Defense Electronic Products, Radio Corp. of America 112

Sikorsky Aircraft Div., United Aircraft Corp. 134
Southwest Airmotive Co. 143
Sperry 146
Stromberg-Carlson, a Div. of General Dynamics Corp. .....92 and 93

Texas Instruments Incorporated ... 54

US Air Force 133

Vertol Aircraft Corp. ..... 116 and 117
Vitro Laboratories, a Div. of Vitro Corp. of America 18

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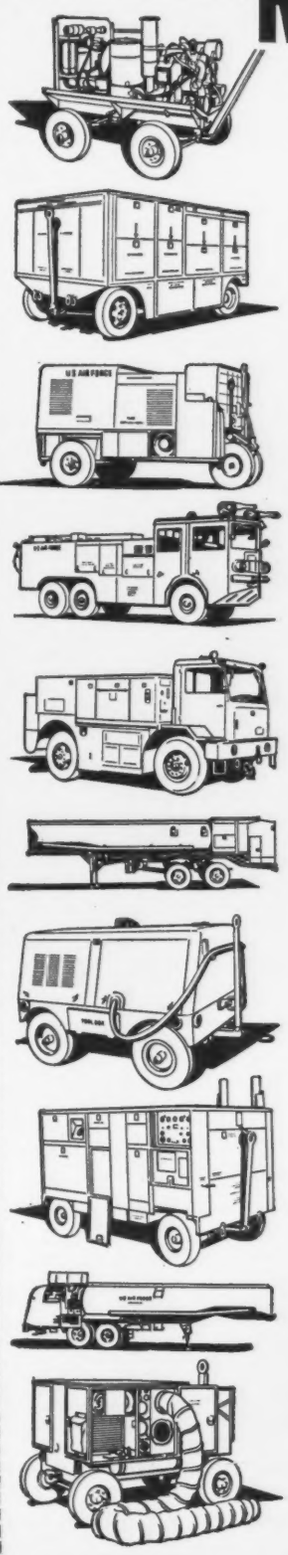

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